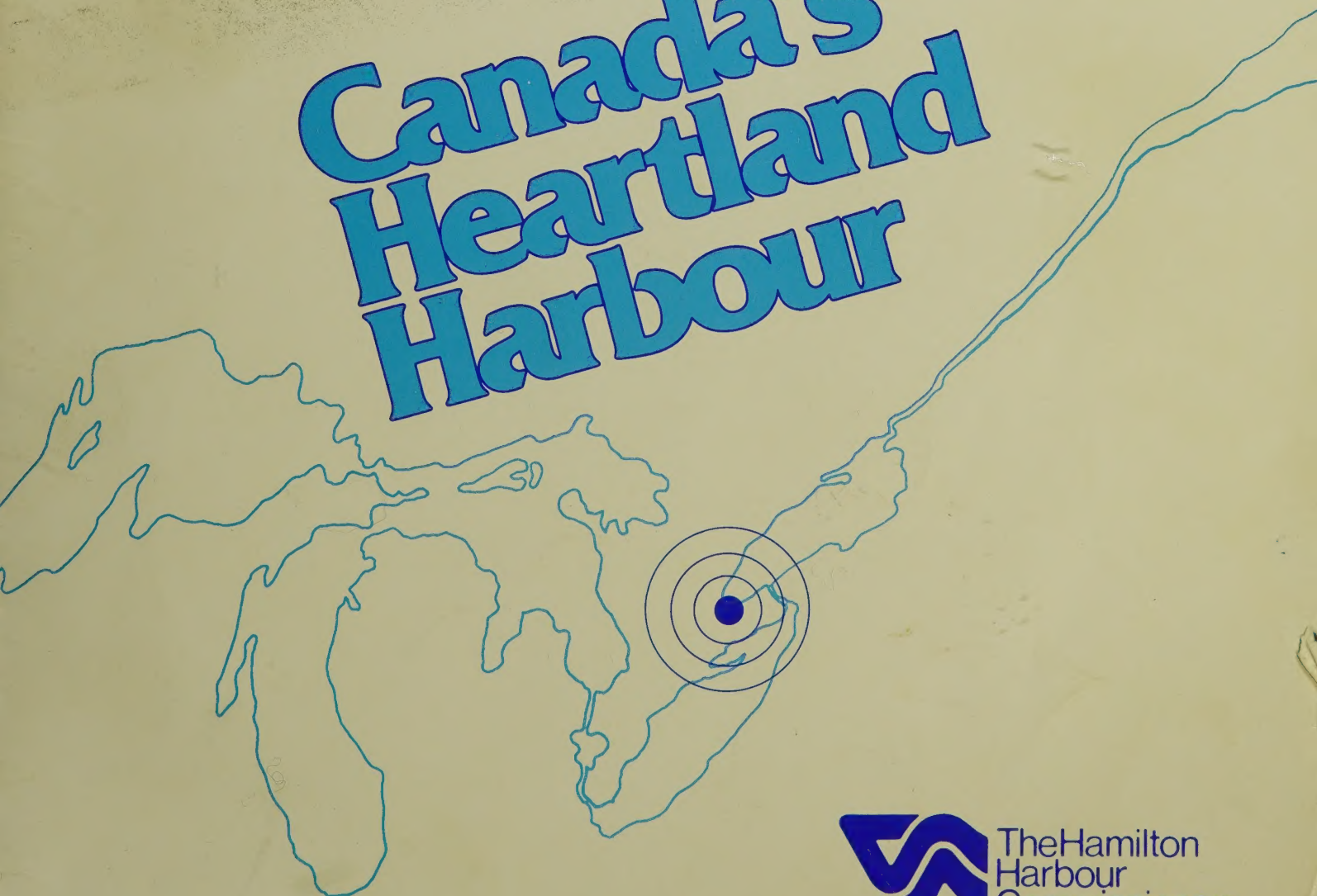
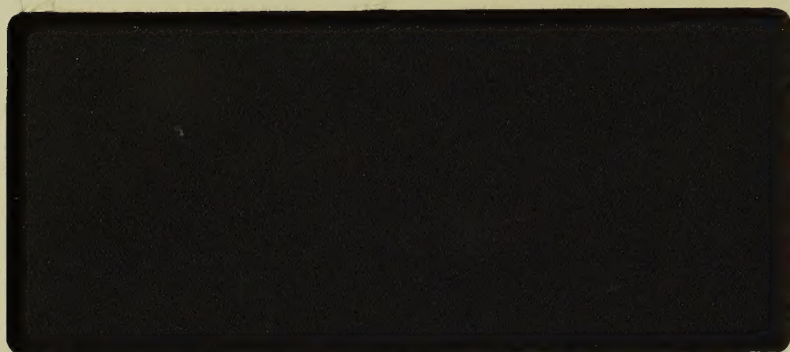


URBAN/MUNICIPAL
CA40NHBL 159
88 W112



Canada's Heartland Harbour





Urban Municipal
CA4 ON HBL I59
88 W112

URBAN MUNICIPAL
SEP 22 1988
GOVERNMENT DOCUMENTS

WINDERMERE BASIN REHABILITATION PROJECT

INITIAL ASSESSMENT FOR THE PARTIAL DREDGING AND FILLING
OF WINDERMERE BASIN

Prepared Under The

FEDERAL ENVIRONMENTAL ASSESSMENT and REVIEW PROCESS

Prepared For

Public Works Canada

and

Hamilton Harbour Commissioners

July 13, 1988

Prepared by

Envirosearch limited

Consulting Engineers

Environmental Specialists

WINDERMERE BASIN REHABILITATION PROJECT

INITIAL ASSESSMENT FOR THE PARTIAL DREDGING AND FILLING
OF WINDERMERE BASIN

Prepared Under The

FEDERAL ENVIRONMENTAL ASSESSMENT and REVIEW PROCESS

Prepared For

Public Works Canada

and

Hamilton Harbour Commissioners

July 13, 1988

Prepared by

Envirosearch limited

Consulting Engineers

Environmental Specialists

July 13, 1988

Mr. Simon Llewellyn
Chairman, Regional Screening
& Coordinating Committee
Environment Canada
25 St. Clair Ave. E.
7th Floor
Toronto, Ontario
M4T 1M2

Re: Windermere Basin Rehabilitation Project

Dear Simon,

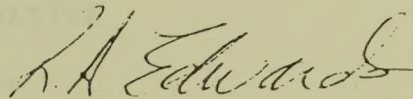
We are pleased to submit 10 copies of the Initial Assessment Document for the above noted project.

This document has been prepared in accordance with the guidelines established by F.E.A.R.O. and the terms of reference which were provided by your department.

The report identified that we do not foresee any adverse environmental impacts which cannot be mitigated through design and construction measures which will be incorporated into the contract documents.

There have been certain issues of concern pertaining to the long term use of the basin identified during the consultation process which should be addressed in due course by appropriate agencies.

Yours very truly,



R.A. EDWARDS, P.ENG.,

PORT ENGINEER

RAE:db

WP 010.RAE

TABLE OF CONTENTS

-----		Page
	PREFACE	iv
	EXECUTIVE SUMMARY	v
1.0	INTRODUCTION	1
2.0	BACKGROUND TO THE PROJECT	4
2.1	EVOLUTION OF THE WINDERMERE BASIN POLLUTION PROBLEM	5
2.2	WINDERMERE BASIN LOADINGS	6
2.3	MAGNITUDE of WINDERMERE BASIN CONTAMINATION	7
2.3.1	Water Quality	9
2.3.2	Sediment Quality	11
2.3.3	Sediment Mobility	23
2.4	EFFECT OF CONTAMINANTS IN WINDERMERE BASIN	25
2.4.1	Effect on Harbour Water Quality	25
2.4.2	Effect on Western Lake Ontario Water Quality	26
2.4.3	Effect on Flora and Fauna Including Fish and Waterfowl	27
2.5	AESTHETICS OF THE WINDERMERE BASIN AREA	28
2.6	PUBLIC CONCERNS AND PERCEPTIONS OF WINDERMERE BASIN	29
2.7	IMPORTANCE AND URGENCY TO RESOLVE PROBLEM	29
3.0	ALTERNATIVES CONSIDERED TO SOLVE WINDERMERE PROBLEM	32
3.1	SEDIMENT DISPOSAL TECHNIQUES	32
3.1.1	On-Site Disposal	32
3.1.2	Dewater Sediment and Transport to a Landfill	34
3.1.3	Dewatering and Incineration of Sediments at the Woodward Avenue Sewage Treatment Plant	35
3.2	WINDERMERE BASIN CLEANUP ALTERNATIVES	36
3.2.1	Do Nothing	36
3.2.2	Complete Dredging and Off-Site Disposal or Incineration	39
3.2.3	Partial Dredging and Fill	41
3.2.4	Raise Water Level	44
3.2.5	Create Marsh on Mudflats	46
3.2.6	Create an Engineered Tertiary Treatment Marsh	48
3.2.7	Channelize and Fill	50
3.3	RANKING of ALTERNATIVES	52
4.0	SELECTION OF AN ALTERNATIVE	57
4.1	SELECTED ALTERNATIVE	57
4.1.1	Most Viable Alternative	60
4.1.2	Partial Dredge/Fill Configuration	62
4.1.3	Proposed Design	65
5.0	DESCRIPTION OF THE PROJECT ENVIRONMENT	71
5.1	THE PHYSICAL ENVIRONMENT	72
5.2	PHYSICAL, BIOLOGICAL and CHEMICAL CHARACTERISTICS	73
5.3	QUANTITY and QUALITY of SEDIMENTS TO BE REMOVED	74
5.4	CONTAMINANTS PRESENT IN BOTTOM SEDIMENTS	78
5.5	PROBABILITY of CONTAMINANTS LEACHING FROM SEDIMENTS	78

TABLE OF CONTENTS (Cont'd.)

	Page
9.2 AFTERNOON DROP-IN SESSION	121
9.3 EVENING PUBLIC INFORMATION SESSION	121
10.0 CONSULTATION WITH ENVIRONMENTAL/REGULATORY AGENCIES	123
10.1 REGION, CITY AND CONSERVATION AUTHORITY CONCERNS	123
10.2 FISHERIES AND OCEANS CANADA MEETING	124
10.3 ONTARIO MINISTRY OF NATURAL RESOURCES MEETING	127
10.4 HAMILTON NATURALIST CLUB	129
11.0 SUMMARY OF CONCERNS	130
11.1 FUTURE CONSIDERATIONS	131
REFERENCES	132

LIST OF TABLES

	Page
Table 1 - 1980 Average Loadings to Windermere Basin	8
Table 2 - Sediment Disposal Alternatives	54
Table 3 - Fill Quality	85

LIST OF FIGURES

	Page
Figure 1 - Sediment Core Sampling Locations	13
Figure 2 - Sediment Core Samples (Core #1)	14
Figure 3 - Sediment Core Samples (Core #2)	16
Figure 4 - Sediment Core Samples (Core #3)	18
Figure 5 - Sediment Core Samples (Core #4)	20
Figure 6 - Sediment Core Samples (Core #5)	21
Figure 7 - Mar-land Alternative I	63
Figure 8 - Mar-land Alternative II	64
Figure 9 - Project Configuration	66
Figure 10 - Stage 1	67
Figure 11 - Stage 2	68
Figure 12 - Stage 3	69
Figure 13 - Pre-Engineering Sediment Sampling	75
Figure 14 - Grain Size Distribution (1, 7, 6)	76
Figure 15 - Grain Size Distribution (2, 3, 4, 5)	77
Figure 16 - Stockpile Material	84
Figure 17 - Containment Berm	87
Figure 18 - Construction Weir	90
Figure 19 - Sediment Trap	101
Figure 20 - Preliminary Construction Schedule	106

APPENDICES

APPENDIX A - PUBLIC CONSULTATION DOCUMENTATION

APPENDIX B - AGENCY CONSULTATION DOCUMENTATION

APPENDIX C - WILDLIFE HABITAT COST ESTIMATES

PREFACE

Investigations by Environment Canada, the Ontario Ministry of Environment, the Windermere Basin Technical Advisory Committee and others have illustrated the need for a clean-up of the Windermere Basin which is located in the southeast corner of Hamilton Harbour.

The Hamilton Harbour Commissioners have initiated the preparatory work necessary to develop a detailed programme for the clean-up of the Windermere Basin in accordance with the Windermere Basin Technical Advisory Committee recommendations.

This document is prepared as an Initial Assessment under the Federal Environmental Assessment and Review Process. This document provides the necessary environmental evaluation information in accordance with the requirements set out by the Federal Environmental Assessment Review Office (FEARO) and Environment Canada Ontario Region.

As the proponent agency, the Hamilton Harbour Commissioners have requested Public Works Canada to undertake the preparation of this document including conducting consultations with other Canada and Ontario government departments and agencies and the public.

EXECUTIVE SUMMARY

Introduction

The Windermere Basin Rehabilitation Project is being funded by a joint group of agencies with the Hamilton Harbour Commissioners agreeing to act as the project proponent. The proposed project is being reviewed under the Federal Environmental Assessment and Review Process (EARP). The basin clean-up is to be accomplished by dredging a portion of the Windermere Basin and disposing of the dredged material in confined disposal areas to be constructed within the Basin, essentially in accordance with the recommendations made by the parties represented on the Windermere Basin Technical Advisory Committee. The final report of the Windermere Basin Technical Advisory Committee entitled "The Dredging of the Windermere Basin and the Disposal of Contaminated Sediments" recommended:

- "1. That the basin be partially dredged,
2. That the sediments be disposed of on site behind containment berms,
3. That the sediments be disposed of without chemical stabilization."

The Windermere Basin, located at the southeast extremity of Hamilton Harbour at the point of discharge of Redhill Creek, is polluted with contaminated sediments from:

- stormwater runoff,
- the City of Hamilton sewage and water treatment plants,
- combined sewer overflows, and
- erosion from upland areas of the Redhill Creek watershed.

Estimated typical discharges to Windermere Basin indicate an average flow of 286,000 cubic metres per day of which 86% is effluent from the Woodward Avenue Sewage Treatment Plant, 13% is streamflow from Redhill Creek and 1% is untreated combined sewage overflows discharged directly to the basin. The data indicate that of the historical loadings discharged to the Windermere Basin, the majority of the suspended solids originate from Redhill Creek, but the loadings of total phosphorus and biochemical oxygen demand are predominantly from the treated effluent from the Woodward Avenue Sewage Treatment Plant plus the combined sewer by-passes directly to the basin.

Background

Concern with the accumulation of contaminated sediments in the

Windermere Basin has generated a number of investigations in the past into possible alternative solutions to correct the problem. The events that lead to the Technical Advisory Committee recommendation of partial dredging and filling are summarized below.

The Ontario Ministry of Environment has conducted sediment analyses that indicate that the basin sediments are of light density with a relatively high organic content. Contaminants in the sediments include high concentrations of volatile organic matter, nutrients, organo-chlorine compounds, pesticides and heavy metals (including zinc, copper, lead, cadmium, chromium, manganese, iron and mercury). The top 16 centimetres of sediment contain the highest levels of contaminants with reduced concentrations of pollutants at deeper depths.

In 1984 Mar-land Engineering Limited undertook a study of ways to remove the sediments from the Windermere Basin. This study recommended the partial dredging of the basin and the disposal of the contaminated sediments in confined disposal facilities constructed within the basin. Mar-land proposed that by locating the containment areas where the largest volume of material has accumulated, the volume of contaminated sediment that must be removed could be minimized.

A report prepared by Envirosearch Limited (1985) for the Windermere Basin Technical Advisory Committee reviewed the following alternatives for the clean-up of Windermere Basin:

- do nothing
- partial dredging
- create marsh
- combination of above.
- complete dredging
- raise water level with dam
- channelize and fill

The Envirosearch report considered various disposal techniques that warranted further consideration for the Windermere Basin sediments including:

- On-site disposal in which a containment area would be created within a portion of Windermere Basin.
- Dewatering of sediments and the transporting of the dewatered sediments to a landfill.
- Dewatering and incineration of the sediments at the Woodward Avenue Sewage Treatment Plant. The organic sediments would be digested and incinerated. Inorganic grit would be separated and disposed with

other grit from the sewage treatment process.

Envirosearch concluded that the most likely alternative for a disposal site for contaminated sediments from Windermere Basin would be the creation of a dyked disposal area within a portion of the Basin, in keeping with the 1984 Mar-land proposal. The potential benefit from isolating the contaminated sediments from the active aquatic environment was seen to offset the loss of any assimilative capacity due to approximately a 50% reduction in the Basin area. However, the overall basin volume will be increased by the proposed dredging. The net increase will range from 28% to 128% at high and low water levels, respectively.

In 1986, the Wastewater Technology Centre at the Canada Centre for Inland Waters conducted a series of tests on the Windermere Basin sediments, including the Ontario Ministry of Environment leaching test that confirmed the non-hazardous nature of the sediments. The tests, however, demonstrated that there was the potential for mobility of contaminants in the sediments when mixed with the overlying water as would occur if sediment were to scour during high flow events or when sediment and water are mixed during hydraulic dredging. The report recommended the need for isolating dredging activities during the removal of heavily contaminated sediments and demonstrated that although the sediments are not hazardous, they do require disposal in a confined disposal facility. The tests indicated a very low potential for the leaching of contaminants from a confined disposal facility. The report concluded that the removal of sediment from the basin is justifiable and preferable to allowing the sediment to remain in their present condition.

Need for Dredging

The volume of Windermere Basin has been reduced by the accumulated sediments to the degree that there is little room remaining to trap sediment and pollutants being discharged to the basin. As a consequence, additional sediment discharging to the basin would either pass through to Hamilton Harbour, or displace contaminated sediment already in the basin which in turn would pass into the harbour.

Also, the contaminated sediments in the basin could be scoured from the basin by high flows such as would exist in a regional storm resulting in large quantities of contaminated sediment being carried through to Hamilton Harbour.

The sparcity of aquatic plants in the majority of the shallow

areas of the basin along with mortalities in the populations of waterfowl that have overwintered in the basin points to the likelihood that a healthy population of flora and fauna cannot be established in Windermere Basin under existing conditions. The proposed dredging will remove the contaminated sediments from the Basin which may activate the return of a healthy mix of flora and fauna in the future.

Description of the Work

The option recommended by the Windermere Basin Technical Advisory Committee is being adopted for the proposed project. An estimated 235,000 cubic metres of sediment is to be removed in this project including the contaminated sediment and underlying material to the 1.0 metre depth in the inlet channel and 1.5 metre depth in the open water area. The material to be excavated for the proposed sediment trap (to a depth of 4.0 metres) totals approximately 113,000 cubic metres. The estimated total dredging quantity, therefore, comes to 348,000 cubic metres.

The first step in the project would consist of constructing a temporary weir at the outlet of the Basin. The weir will increase the retention period in the basin during construction and serve to capture the sediment bedload generated during berm construction and dredging activities. The weir will also be used to maintain proper depths of water in the basin to permit operation of hydraulic dredging equipment.

Berms will be constructed to form confined disposal areas that will isolate the sediments to be removed from the main body of the basin and dredging will be carried out in stages. All flow will be diverted through a temporary channel around the south and west sides of the basin during the period when the most contaminated sediments are hydraulically dredged in a doubly closed system.

After the most heavily contaminated sediments have been dredged, the berms will be modified to route flow through the basin while the final depths are dredged and the dredged sediment is deposited in the confined disposal areas, located along the south and west sides of the basin.

The dredged sediment deposited in the confined disposal areas will be allowed to dewater and consolidate for a period of one or two years. After the sediments have sufficiently consolidated, the Hamilton Harbour Commissioners plan to

undertake to place a 1.0 metre thick capping of clean material over the deposited dredged material. It is anticipated that the capping work will be carried out during the winter of 1990.

Clean capping material will be dumped along the cell berms and worked in toward the centre of each cell using a bulldozer. The work will proceed on several cells concurrently at a rate that permits frost penetration of the placed capping material such that adequate strength is developed in the cap to support the equipment being used in the capping operation.

It is estimated that work on this project will commence in September 1988 and continue into 1989. The confined disposal areas would be allowed to dewatered through to the fall of 1989. Capping would be undertaken during January and February of 1990 and site clean-up and landscaping would be undertaken during the summer of 1990.

Environmental Impacts

The project, upon completion, will have a significant environmental benefit in the removal of highly contaminated sediments from the active aquatic environment of the basin. Also, in the process the basin will be configured to provide a more efficient flow regime and settling areas.

The dredged sediments will be disposed of in the engineered disposal areas which will be designed to completely isolate the deposited sediments. There is no potential for leachate escaping through the disposal area berms. There are no detrimental effects expected from the project and steps are being incorporated to minimize turbidity and the release of contaminants during construction and dredging. Also, a comprehensive environmental monitoring program will be put in place during implementation of the project.

All adverse effects have been identified and can be mitigated through design and construction features. The project can therefore proceed as long as all mitigative measures are incorporated in the contract documents.

There were, however, certain issues/concerns pertaining to the long term future of Windermere Basin identified during the public consultation process which should be addressed in due course by the appropriate agencies.

Future Concerns

One area of concern is the management of soils in the Redhill Creek watershed which includes farmland as well as other properties. Without improvements in sediment control, over 70% of the present sedimentation occurring in Windermere Basin will continue. It will be vital that agencies such as the Ontario Ministry of Agriculture and Food and the Hamilton Region Conservation Authority enhance their efforts to reduce the upland erosion problem along with the Region of Hamilton-Wentworth and the City of Hamilton dealing with erosion from construction at urban development sites if the sediment loading is to be reduced to permit the Windermere Basin to survive into the long term future following the proposed clean-up.

A consultation program was undertaken as part of this assessment. The environmental/regulatory agencies and the public groups and individuals commenting generally supported the clean-up of the Windermere Basin. There was a desire to see wildlife habitat re-established if possible. A second concern involved the determination of long term land use associated with the confined disposal areas for the dredged material.

The fact that the major portion of the flow through the basin is from the sewage treatment plant is cause for concern. The effluent from the sewage treatment plant may contain a number of substances which could be harmful to fish, waterfowl and wildlife populations. Therefore, the addition of special features requested during the consultation program, such as gently sloped sections of the basin bottom to attract waterfowl is considered to be premature at this stage of the rehabilitation project. Following the completion of the proposed dredging and disposal project, the basin should be carefully monitored for a period of time to assess its suitability for wildlife habitat. A decision will then have to be made, as to how fish and wildlife, including the population of waterfowl that frequent Windermere Basin, especially during the winter months, can be best accommodated through the provision of special features.

The land use concerns voiced during the public consultation program generally related to future land use of the confined sediment disposal areas. There was concern that the disposal areas are suitably landscaped as soon as possible to improve the basin aesthetics. Several suggestions were received for future use including public access, wildlife habitat and commercial/industrial. The mandate of the clean-up project for Windermere Basin does not extend to setting future land use constraints. The existing jurisdictions have the authority to set future land uses.

WINDERMERE BASIN PROJECT

Fact Sheet

LOCATION: Southeast extremity of Hamilton Harbour

AREA: Before rehabilitation - 47 Hectares
After rehabilitation - 22 Hectares

FLOW INPUTS: Woodward Avenue STP - 245,000 cu. m./day (85.7%)
(1982 data) Redhill Creek - 37,000 cu. m./day (12.9%)
Combined Sewage
Overflows - 4,000 cu. m./day (1.4%)

	Sus. Solids	Tot. Phos.	BOD-5
Redhill Creek	67.5%	11.6%	8.9%
STP + Combined			
Sewer Overflows	32.5%	88.4%	91.1%

DREDGING VOLUME: The project will excavate 240,000 cu. m. from 1.0 to 1.5 m. depth from the centre 22 Hectare portion of the basin to remove the contaminated sediments.

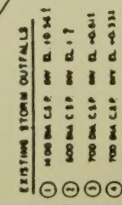
Sediment trap dredging will be 113,000 cu. m.

BASIN VOLUME: Basin volume at low water (74.4 m.)
Existing - 231,000 cu. m.
After Dredging - 526,000 cu. m.

Net Increase - 295,000 cu. m.
- 128%

Basin volume at high water (74.9 m.)
Existing - 495,000 cu. m.
After Dredging - 634,000 cu. m.

Net Increase - 139,000 cu. m.
- 28%



1.0 INTRODUCTION

A clean-up of the Windermere Basin is to be undertaken by a joint group of agencies led by the Hamilton Harbour Commissioners with the proposed works being reviewed under the Federal Environmental Assessment and Review Process (EARP). The proposed clean-up is to be accomplished by dredging a portion of the Windermere Basin and disposing of the dredged material in confined disposal areas to be constructed within the Basin, essentially in accordance with the rehabilitation alternative developed among the parties represented on the Windermere Basin Technical Advisory Committee.

This document describes and evaluates environmental consequences for undertaking the project. The selected alternative for the project is discussed including the mitigative measures that can be undertaken to ensure that the project does not adversely impact the surrounding environment. The alternative approaches considered to undertake the clean-up of Windermere Basin are reviewed and the related environmental factors including the positive and negative benefits are explained for each alternative.

This Initial Environmental Assessment Report is prepared as per the approach outlined in the Federal Environmental Assessment and Review Process (EARP) guideline 'INITIAL ASSESSMENT GUIDE' and in accordance with an outline recommended by Environment Canada.

The first part of this Initial Assessment Report provides information obtained from a review of previous documents and reports related to the project. These documents and reports are identified in the References.

The second part of this Initial Assessment Report describes the detailed approach to be taken to implement the project, consultations held with the public and agencies and the specific information outlining the mitigative measures to be incorporated to safeguard the surrounding environment. The information describing the project details has been discussed with representatives of interested parties including:

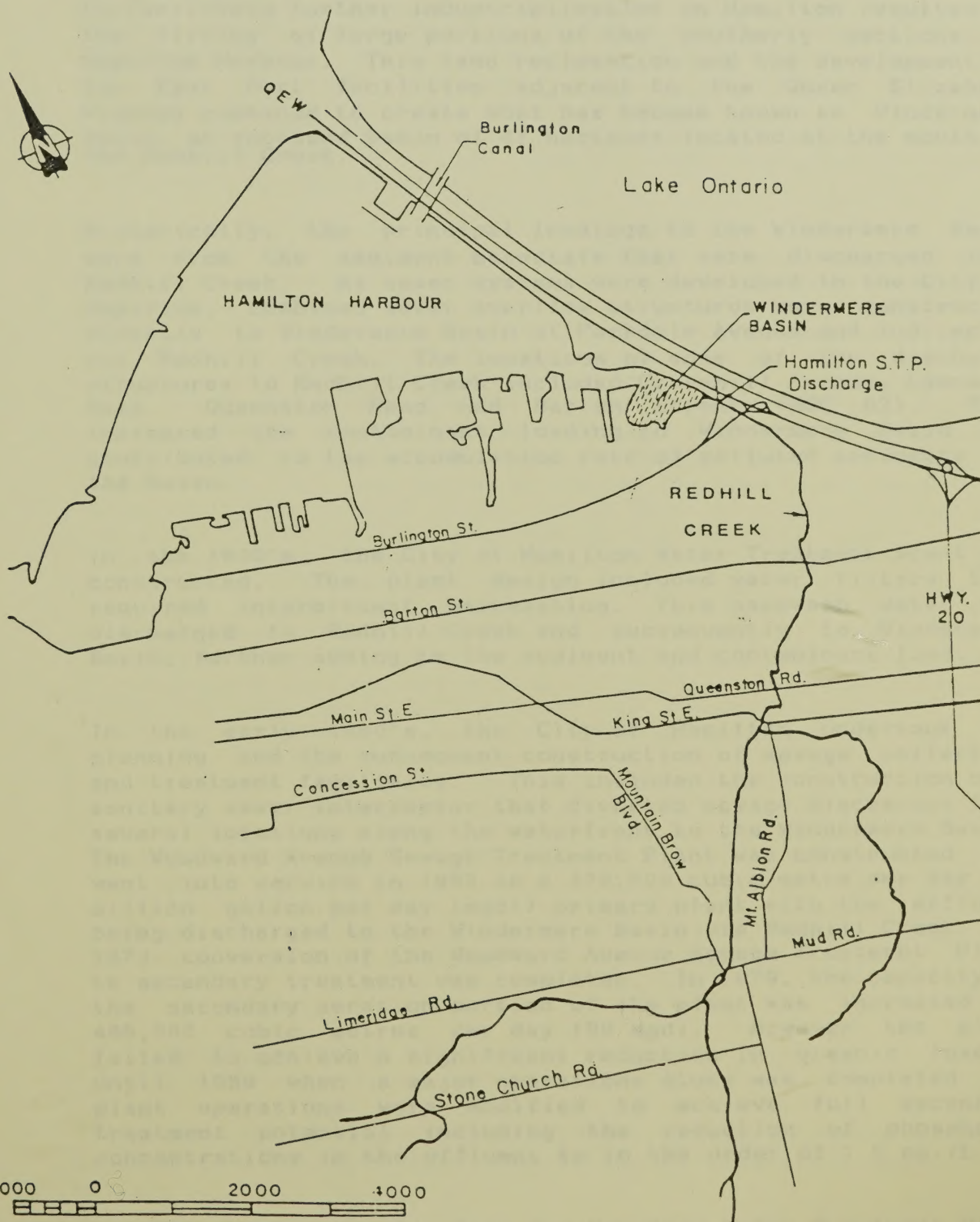
- Public Works Canada,
- Mar-land Engineering,
- Environment Canada,
- Hamilton Harbour Commissioners,
- Ontario Ministry of Environment,
- Canadian Wildlife Service (**),
- Hamilton Naturalists Club,
- Ontario Ministry of Natural Resources,

- Hamilton Region Conservation Authority,
- Region of Hamilton-Wentworth,
- City of Hamilton,
- Hamilton Harbour Remedial Action Plan
Stakeholder Group,
- public at 2 information sessions.

- ** - telephone discussions were held with the Canadian Wildlife Service to determine their concerns. A meeting was arranged for further discussions, however, no CWS representative attended. No further contact was made with the study team by Canadian Wildlife Service officials.

Concerns expressed have been addressed and remedial measures developed to mitigate the environmental problems that have been identified. A monitoring programme that will measure and test environmental quality against established benchmarks is described.

REDHILL CREEK, WINDERMERE BASIN DRAINAGE SYSTEM



2.1 EVOLUTION OF THE WINDERMERE BASIN POLLUTION PROBLEM

The land reclamation activities that commenced in the 1950's to facilitate further industrialization in Hamilton resulted in the filling of large portions of the southerly sections of Hamilton Harbour. This land reclamation and the development of the East Port facilities adjacent to the Queen Elizabeth Highway combined to create what has become known as Windermere Basin, an enclosed basin of 47 hectares located at the mouth of the Redhill Creek.

Historically, the principal loadings to the Windermere Basin were from the sediment materials that were discharged from Redhill Creek. As sewer systems were developed in the City of Hamilton, combined sewer overflow structures were constructed directly to Windermere Basin at Parkdale Avenue and indirectly via Redhill Creek. The locations of some of the discharge structures to Redhill Creek included Greenhill Avenue, Lawrence Road, Queenston Road and Barton Street (MOE 82). This increased the contaminant loading to Windermere Basin and contributed to the accumulation rate of polluted sediments in the basin.

In the 1930's, the City of Hamilton Water Treatment plant was constructed. The plant design included water filters that required intermittent backwashing. This backwash water was discharged to Redhill Creek and subsequently to Windermere Basin, further adding to the sediment and contaminant load.

In the early 1960's, the City of Hamilton undertook the planning and the subsequent construction of sewage collection and treatment facilities. This included the construction of a sanitary sewer interceptor that diverted sewage discharges from several locations along the waterfront to the Windermere Basin. The Woodward Avenue Sewage Treatment Plant was constructed and went into service in 1963 as a 270,000 cubic metre per day (60 million gallon per day (mgd)) primary plant with the effluent being discharged to the Windermere Basin via Redhill Creek. In 1973 conversion of the Woodward Avenue Sewage Treatment Plant to secondary treatment was completed. In 1979, the capacity of the secondary aeration portion of the plant was increased to 405,000 cubic metres per day (90 mgd). However the plant failed to achieve a significant reduction in organic loading until 1980 when a major operations study was completed and plant operations were modified to achieve full secondary treatment potential including the reduction of phosphorus concentrations in the effluent to in the order of 1.5 mg./L.

In 1981, backwash water from the Hamilton Water Treatment Plant was diverted from Redhill Creek to the Woodward Avenue Sewage

Treatment Plant.

Through the selective addition of industrial wastes to the sewage stream, it was possible to reduce the phosphorus concentration in the effluent from the Woodward Avenue Sewage Treatment Plant to approximately 0.6 to 0.7 mg./L. over the period from 1982 to 1985. Following 1985, phosphorus concentrations in the effluent increased. Currently investigations are underway to determine what must be done to re-establish the previous 1982 to 1985 phosphorus removal efficiency at the plant.

To reduce the discharge of pollutants from combined sewer overflow structures, a stormwater management program has been instituted in Hamilton. This program has included the construction of a holding facility to retain combined sewage overflows at Greenhill Avenue. Hamilton engineering staff estimate that this structure will eliminate the discharge of 95% of the BOD and suspended solids currently being discharged to the Redhill Creek from the Greenhill combined sewer by-pass. The Greenhill combined sewer by-pass has traditionally represented in the order of 70% of the combined sewage by-passing to the Redhill Creek. This facility could foreseeably lead to a 60% to 70% reduction in the combined sewer bypass loadings to Redhill Creek. In addition, the Region of Hamilton Wentworth has reduced the by-passing of combined sewage directly to the Windermere Basin by increasing maximum flows through the primary portion of the Woodward Avenue Sewage Treatment Plant before opting for a by-pass. This has led to an increased average daily flow being treated at the plant. In 1982 the average daily treatment was in the order of 62 to 63 mgd. In 1987 the average daily flow was approaching 75 mgd.

From the 1930's to 1981, the Windermere Basin received solids from backwashing water treatment plant filters. Over the period from the 1950's to date, the Windermere Basin has been the point of discharge for additional loadings as discussed above. The net result has been the accumulation of contaminated sediments throughout the Basin. The programs now underway are reducing those loadings significantly.

2.2 WINDERMERE BASIN LOADINGS

Previous studies have identified the source and quantity of a number of pollutants being discharged to Windermere Basin.

The Ministry of the Environment - Windermere Basin Study (1982) indicates that the total discharges to Windermere Basin averaged 286,000 cubic metres per day of which 245,000 cubic metres per day (85.7%) was effluent from the Woodward Avenue Sewage Treatment Plant, 37,000 cubic metres per day (12.9%) was streamflow from Redhill Creek and 4,000 cubic metres per day (1.4%) was untreated combined sewage overflows discharged directly to the Windermere Basin. The data indicate that on the average, 67.5% of the suspended solids, 11.6% of the total phosphorus and 8.9% of the biochemical oxygen demand loadings to Windermere Basin were from Redhill Creek. The remaining 32.5% of the suspended solids, 88.4% of the total phosphorus and 91.1% of the biochemical oxygen demand loadings were from the treated effluent from the Woodward Avenue Sewage Treatment Plant plus the combined sewer by-passes directly to the Windermere Basin. These loadings are summarized in Table 2.3 of the Windermere Basin Study presented herein as Table 1.

Since 1982, there have been some improvements in treatment at the Woodward Avenue Sewage Treatment Plant along with the construction of a large stormwater holding tank facility upstream at the Greenhill Avenue combined sewer overflow, the latter facility being designed to reduce the quantity of combined sewer by-pass flow to the Redhill Creek. As indicated previously, these improvements have resulted in some loading reductions. As additional improvements are completed, further enhancement of water quality in the Windermere Basin will result.

2.3 MAGNITUDE OF WINDERMERE BASIN CONTAMINATION

As part of the Initial Assessment, Envirosearch undertook an analysis of previous studies that addressed the problem of the accumulated sediments in Windermere Basin. These investigations dealt with the environment of Windermere Basin with attention focussed on water and sediment quality. The potential for contaminants leaching from a confined sediment disposal area was investigated by the Wastewater Technology Centre of Environment Canada. The potential for the sediments to be scoured from the basin under specific conditions was previously reported by Envirosearch (1985).

The findings of the previous work are reviewed below in the order of:

- water quality
- sediment quality
- sediment mobility.

TABLE 1

1980 AVERAGE LOADINGS TO WINDERMERE BASIN

Loadings - Urban Non-Point	All Loadings in kg/day			Suspended Solids	Ammonium Nitrogen	Total Phosphorous
	Flow (M ³ /d)	Biochemical Oxygen Demand				
Redhill Cr.	37,000	617		39,000	186	60.8
Parkdale c/s	3,000	83		4,940	25.4	8.6
Woodward c/s	1,000	40		2,140	10.9	3.6
Total Urban Non-Point	41,000	740		46,080	222	73.0
Loadings - Urban Point						
Hamilton STP*	245,000	6,125		9,065	8,820	443
Hamilton WTP**		56		2,640	19	7
Total Urban Point	245,000	6,181		11,705	8,839	450
Total Estimated Loadings - All Sources	286,000	6,921		57,785	9,061	523

* Treatment Modification @ STP have reduced these loadings since 1980.

** WTP Filter Backwash now directed to STP

c/s - Combined sewer overflow

TABLE 1 - Taken from Windermere Basin Study - MOE, 1982 (Table 2.3)

2.3.1 Water Quality

As part of the 1985 Envirosearch study, water quality data (including total phosphorus, total Kjeldahl nitrogen, phenolics, BOD-5, aluminum, cadmium, chromium, copper, nickel, lead and zinc) were analysed for Windermere Basin, Redhill Creek and the discharge channel from the Basin. The Envirosearch study found that concentrations of a number of the parameters including total Kjeldahl nitrogen, aluminum, chromium, copper, nickel, lead and zinc all increased with travel through the initial portion of the basin. From approximately the midpoint of the basin to the outlet these parameters then reduced in concentration. The total phosphorus and phenolics analyses showed a similar trend, however, the peak concentrations occurred closer to the inflow to the Basin. No clear trends were evident for BOD-5 and cadmium concentrations. The suspended solids analysis indicated higher levels in Redhill Creek upstream from the Woodward Avenue Sewage Treatment Plant than in the plant effluent. Suspended solids were then observed to increase with travel through the initial portion of the basin. From approximately the midpoint of the basin to the outlet the suspended solids reduced in concentration similar to the previous findings for other water quality parameters. The apparent increase in concentration of pollutants in the water column followed by a decrease in concentration was reported as a possible resuspension mechanism in action in the basin whereby pollutants are being released from the sediments into the water column. Presumably, this would be a scour-related phenomenon in which the degree of change in the various parameters with travel through the basin varied with the level of flow. Typically, the most severe changes accompanied high flow conditions. The reduction in concentrations in the downstream area of the basin was attributed to the basin assimilating pollutants in the water column in this portion of the basin. Presumably, if the sediments were not present to be scoured and the initial increase in pollutant concentrations did not occur, the water quality at the outlet from the basin would be significantly better than the incoming quality. No specific investigations were undertaken to confirm the preceding hypothesis.

The Envirosearch study also illustrated the significance of Redhill Creek in contributing suspended solids to the Windermere Basin sediments. On one occasion following a heavy rainfall, the concentration of suspended solids in Redhill Creek increased fivefold from an average dry weather level of 16 mg/l to 90 mg/l. At the same time, the Woodward Avenue Sewage Treatment Plant suspended solids concentration increased only 50% from an average dry weather level of 12 to 19 mg/l. The suspended solids level then decreased with distance travelled through the basin. During this storm event Windermere Basin entrapped some suspended solids, however, most of the suspended solids loading flowed through to Hamilton Harbour.

Envirosearch reported that PCB's were detected in the water column in Windermere Basin in concentrations ranging from 25 to 90 ug/L. The Ontario Ministry of Environment 1985 report 'Hamilton Harbour, Technical Summary and General Management Options' stated that:

"PCB's were seldom detected (sensitivity 0.02 ug/L) in Red Hill Creek. During runoff, PCB concentrations up to 0.05 ug/L were found."

The same Ontario Ministry of Environment study identified approximately 40 polynuclear aromatic hydrocarbons (PAH's) at concentrations in the range of 0.02 to 0.3 ug/L in the Woodward Avenue Sewage Treatment Plant effluent discharging to Windermere Basin. No data were available on the concentrations of these parameters at the discharge from the basin.

Envirosearch calculated total oxygen demand at the input to and the outlet from the Basin. The average daily flows from the Woodward Avenue Sewage Treatment Plant and Redhill Creek (stream gauging station no. 02HA014) were used in conjunction with the total Kjeldahl nitrogen and BOD-5 data. Envirosearch used the relationship that equated the total oxygen demand to the sum of the ultimate biochemical oxygen demand (BOD) plus the nitrogenous oxygen demand. The ultimate BOD was assumed to equal the BOD-5 $\times 2$ and the nitrogenous oxygen demand to equal the total Kjeldahl nitrogen $\times 4.57$. The report indicated that there was some reduction in the total oxygen demand through the Windermere Basin during periods when the total flowthrough was stable and in the order of 300,000 cubic metres per day or less. As the flow increased during periods of storms the quality in the basin deteriorated, possibly due to sediment scour.

The Hamilton Harbour Technical Summary and General Management Options (August 1985) reported that the Woodward Avenue Sewage Treatment Plant was the major source of BOD, phosphorus and free ammonia loadings to Hamilton Harbour. The report estimated annual pollutant loadings to Hamilton Harbour from known point sources for 1977, 1982 and 1983. The 1977 data indicated 28% of the BOD, 8% of the suspended solids, 44% of the total phosphorus and 67% of the free ammonia loadings to the Harbour were from the Woodward Avenue Sewage Treatment Plant. The 1982 data indicated 27% of the BOD, 10% of the suspended solids, 69% of the total phosphorus and 75% of the free ammonia loadings to the Harbour were from the sewage treatment plant. A comparison of 1983 loadings from the sewage treatment plant and the Stelco and Dofasco steel operations indicated that the sewage treatment plant contributed BOD loadings equal to 100%, suspended solids loadings equal to 15%, total phosphorus loadings equal to 380% and free ammonia loadings equal to 470% of the steel producers loadings. The report identified the Woodward Avenue Sewage Treatment Plant as

a major loading source to the Hamilton Harbour indicating that:

"The Hamilton sewage treatment plant may be a major factor in future algal biomass control through phosphorus limitation in the harbour since it will remain the largest source of phosphorus to the harbour."

The report also went on to indicate that:

"the highest coliform densities are found in the area immediately adjacent to Windermere Basin."

2.3.2 Sediment Quality

The investigations that have been undertaken relating to the quality of sediment in the Windermere Basin indicate serious pollution of the sediments.

The Ontario Ministry of Environment has undertaken a study of the sediment quality at several locations throughout Ontario. This investigation, 'The In Place Pollutants Program - Volume III - Phase 1 Studies' (Persaud et al. 1987) reports the condition of sediments found during the study. The report stated that:

"in Windermere Basin, the enrichment appears to be due to mainly industrial materials such as solvent extractables (oils and greases)."

The report goes on to explain that:

"Windermere Basin sediment showed excessively high values for all parameters measured (except mercury)".

The In Place Pollutants Program data is consistent with other investigations.

The efforts to initiate a clean-up of the Hamilton Harbour have resulted in the development of a 'Remedial Action Plan' for the harbour. The reports prepared as part of this plan have discussed the Windermere Basin problem. The 1988 Remedial Action Plan for Hamilton Harbour made specific comments related to Windermere Basin. The report stated that:

"the Windermere Basin Study (1986) and recommended remedial actions be considered separately from and proceed in advance of the overall Harbour RAP, providing that the Ontario and Federal Environment Ministers ensure full public consultation and hearing on the alternatives."

The preceding recommendation supports the proposed Windermere Basin clean-up.

The 1982 Ontario Ministry of Environment Windermere Basin Study indicated that PCB's were distributed in the sediment throughout the Basin. The concentrations of PCB's in the Windermere Basin sediments were compared to the Ontario guidelines for permissible levels of PCB's in sediment (50 ug/kg) for open water sediment disposal. All Windermere Basin sediment samples were found to contain PCB's in concentrations that exceeded the guideline. The average concentration of PCB's in the sediment was reported to be 1241 ug/kg (ie: 25 times the specified guideline). The maximum concentration of 3430 ug/kg was 68 times the guideline.

The 1985 Envirosearch report found that sediment data collected in 1984 indicated similar quality to the sediments described in the 1982 Windermere Basin Study. The Envirosearch report included the analyses of core samples of the basin sediment that were collected at four locations in 1976. The levels of several metals in two core samples collected near the outlet of Redhill Creek to the Windermere Basin exceeded MOE guideline levels by factors of 20 to 50 in the top 16 centimetres and 10 to 20 between 16 and 60 centimetres with levels approaching the MOE guideline levels at approximately 60 centimetres depth. At 65 centimetres depth the concentration of total nitrogen and organic matter (indicated by the loss on ignition test) increased significantly. This depth of 65 centimetres coincided with the level at which old root material was observed in the sediment by Ontario Ministry of Environment survey staff. The data for a sediment core sample collected in the vicinity of the mudflat near the central portion of the basin showed a similar initial reduction of contaminants but at a depth of 32 centimetres instead of the 16 centimetres previously discussed. At this location there was no indication of increased total nitrogen or organic matter as per the previous core samples. Two core samples located near the outlet from the basin indicated higher levels of pollutants in the top 7 to 8 centimetres with a reduction at lower levels. The location map and bar charts from the 1985 Envirosearch report (Figures 5 through 10) indicating the concentrations of pollutants at specific depths for each location discussed above are presented herein as Figures 1 through 6.

The Envirosearch report suggested that the original level of the bed of the basin (where plant matter was found) was approximately 60 to 65 centimetres below the existing surface of the sediments located near the inlet to the basin. The report suggested that the sediments began to accumulate pollutants as industrialization and development began in the Hamilton area. The significant increase in pollutants at the 16 centimetre depth was thought to possibly correlate to a

WINDERMERE BASIN

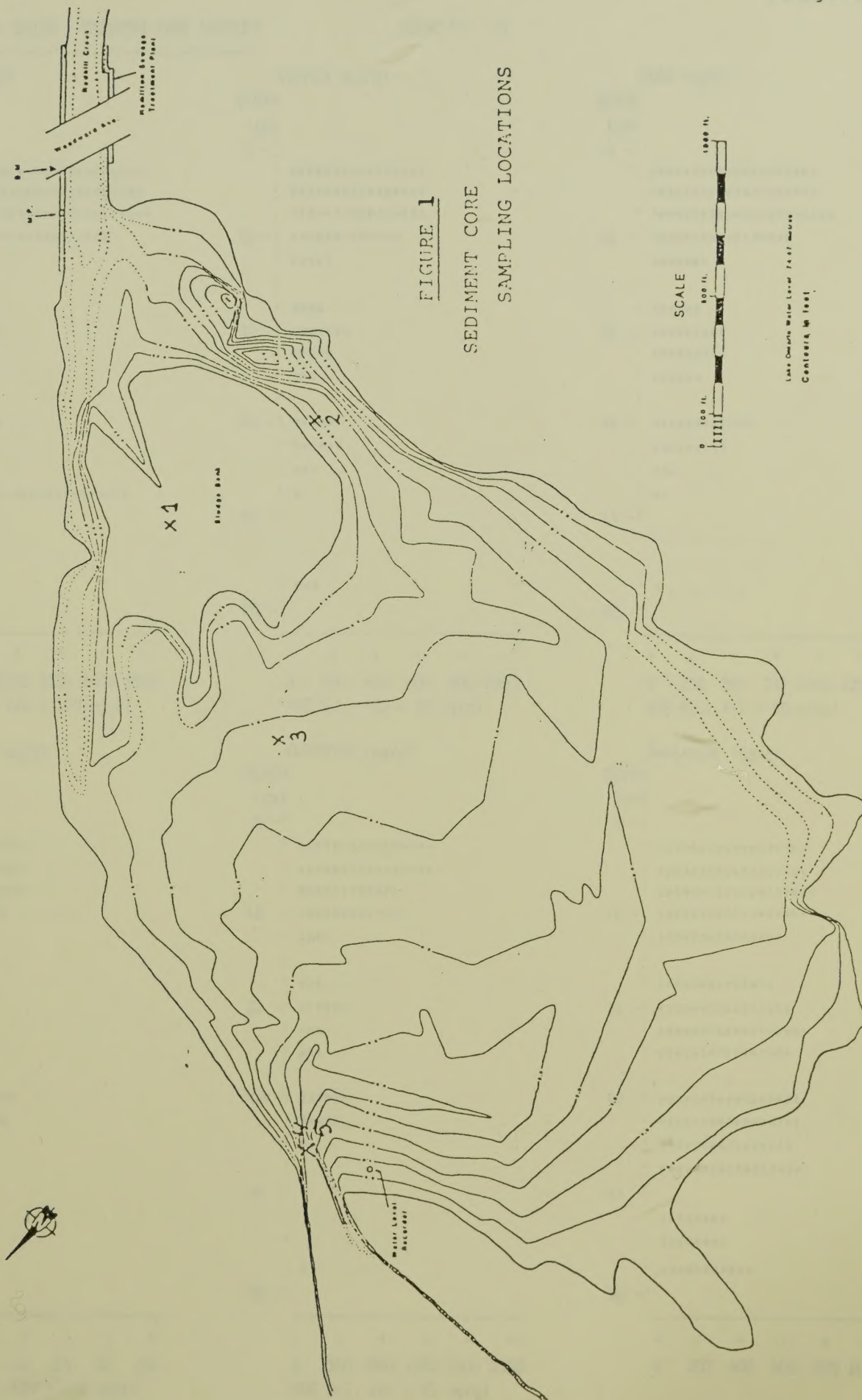


FIGURE 1
SEDIMENT CORE
SAMPLING LOCATIONS

SCALE
0 100 ft 200 ft 400 ft

Lake Ontario Water Level Recorder
Contour, 10 feet

FIGURE 2
WINDERMERE BASIN - SEDIMENT CORE SAMPLES

(CORE #: 1)

Page 14

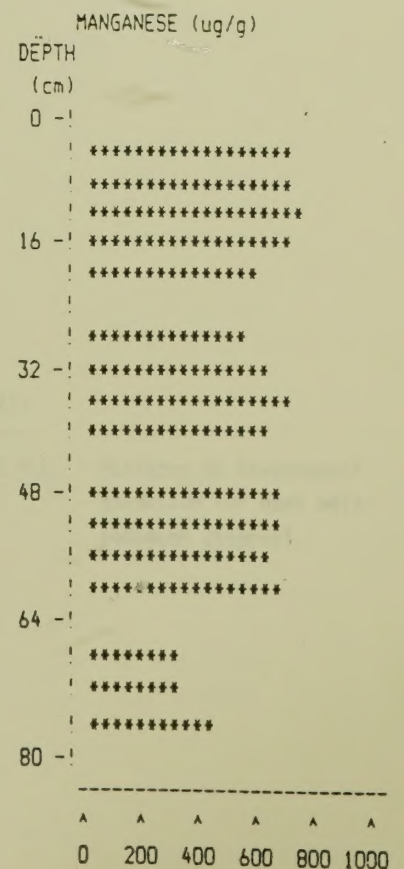
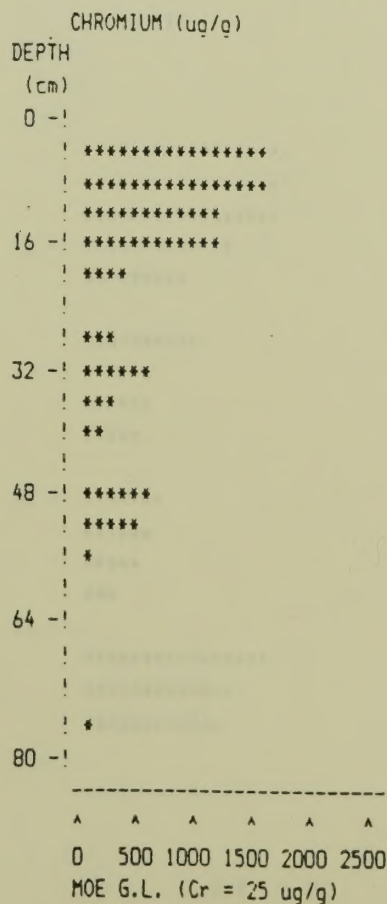
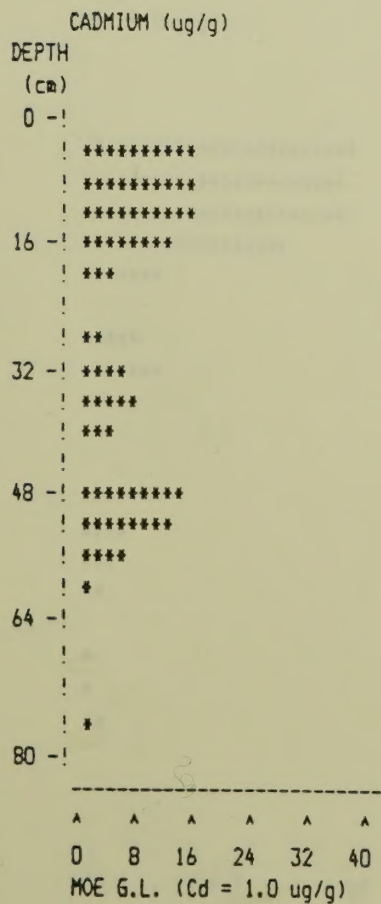
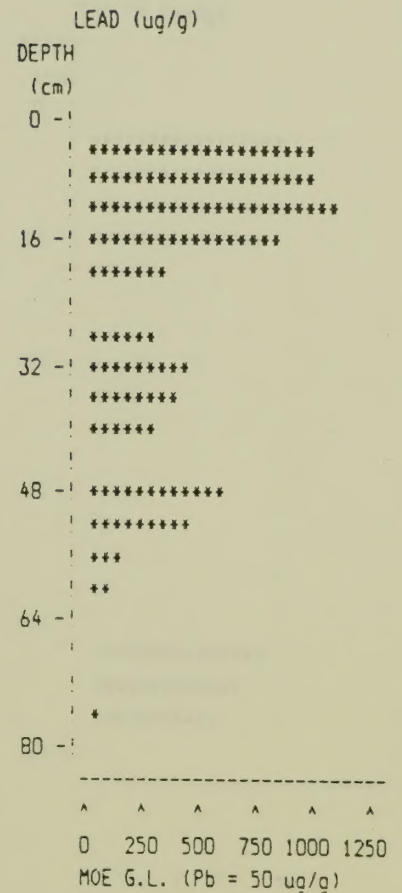
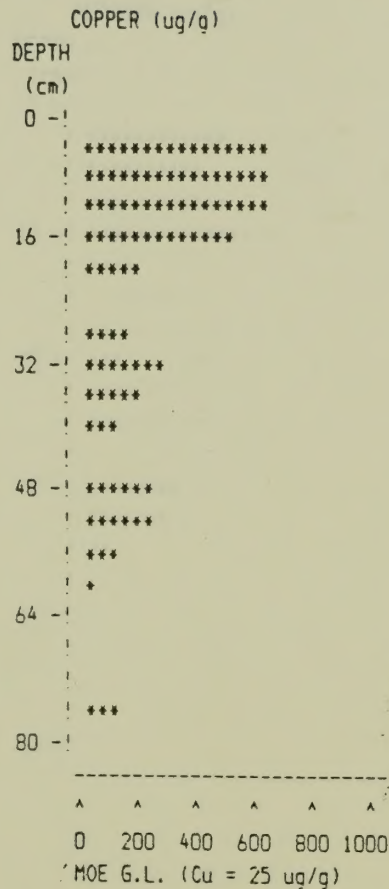
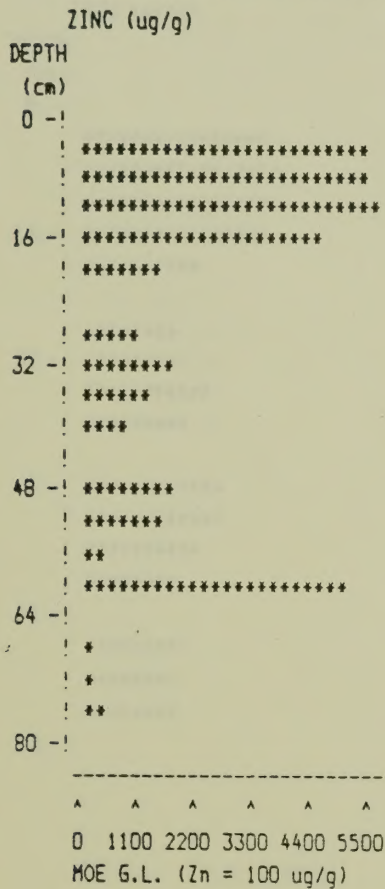
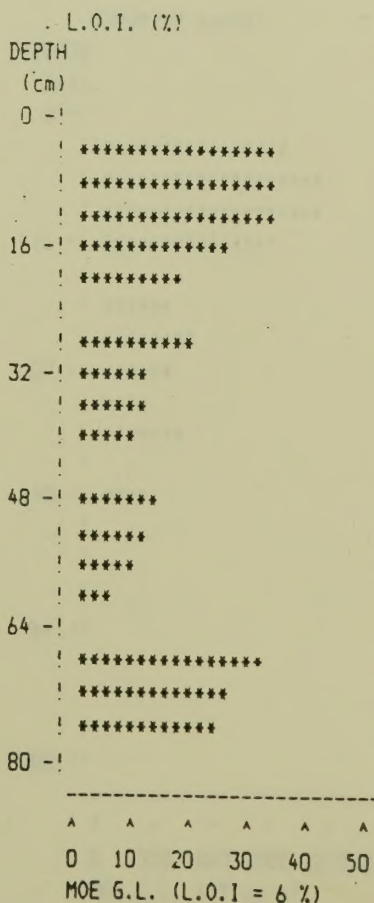
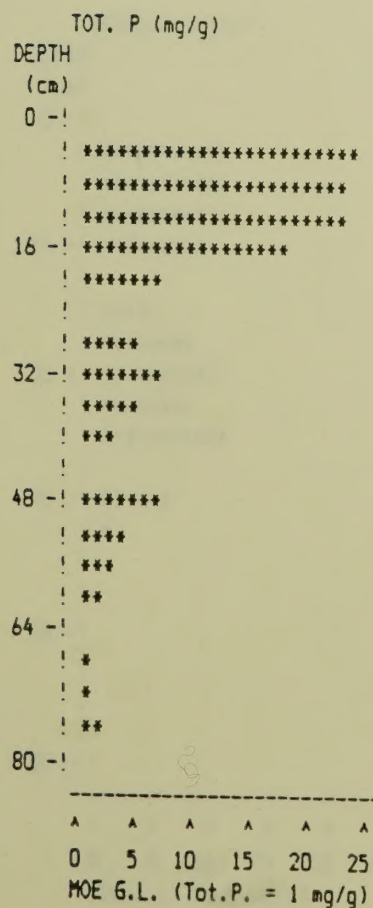
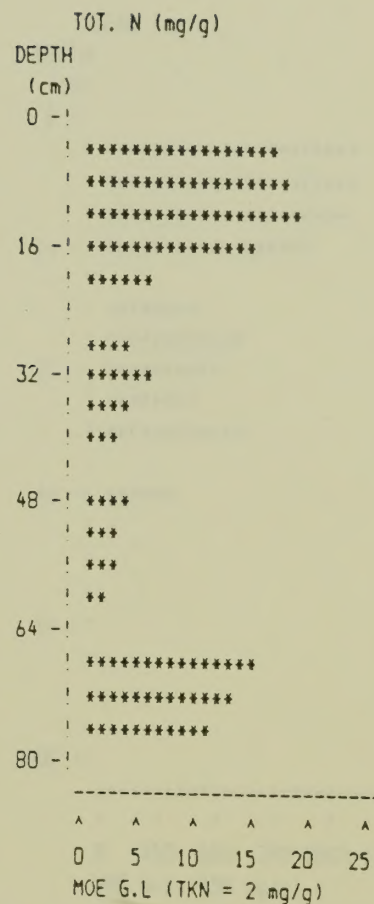
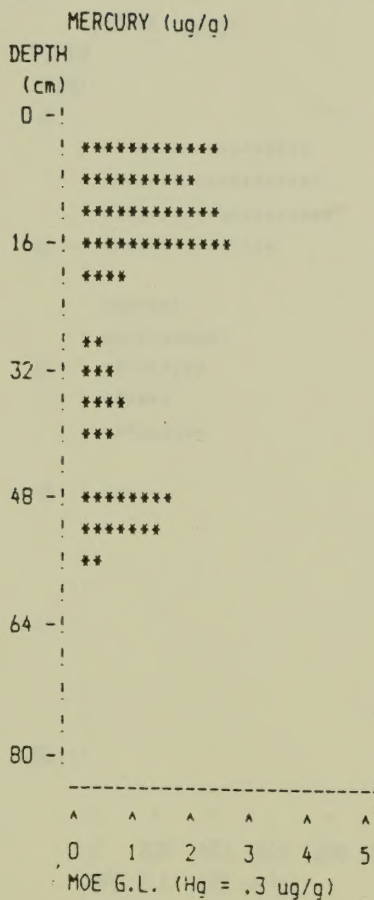
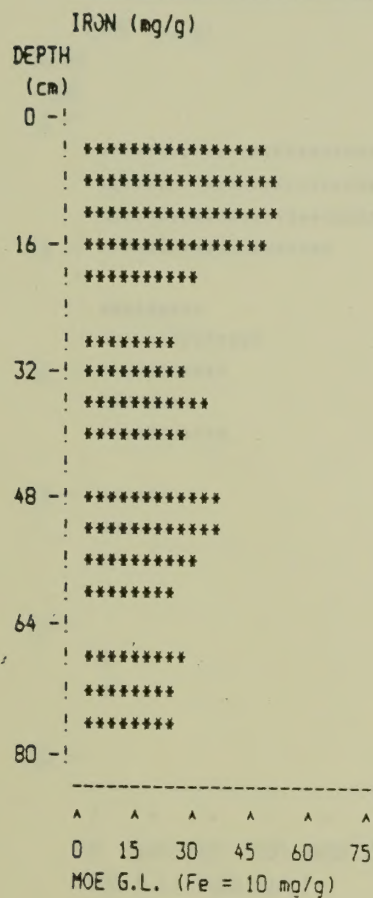


FIGURE 2 (cont'd)
WINDERMERE BASIN - SEDIMENT CORE SAMPLES

(CORE #: 1)



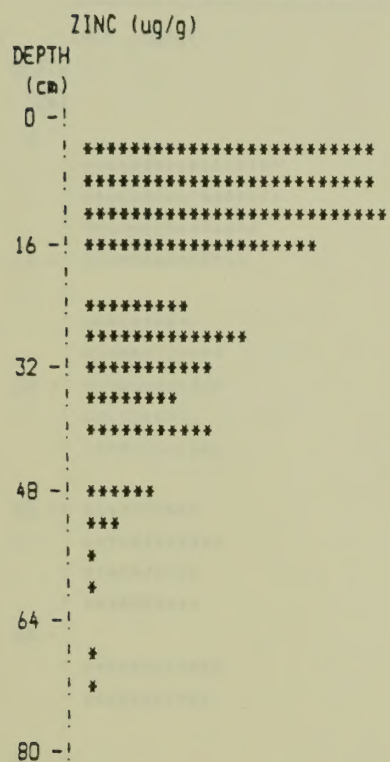
NOTE:

MOE G.L. - Ministry of Environment
guideline for open water
sediment disposal.

FIGURE 3

WINDERMERE BASIN - SEDIMENT CORE SAMPLES

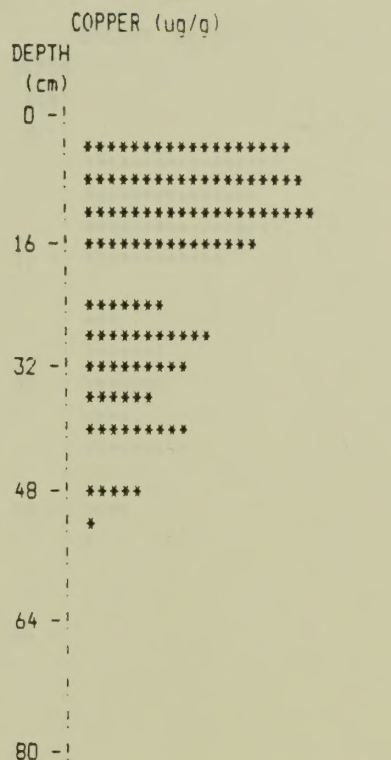
(CORE #: 2)



A A A A A A

0 1100 2200 3300 4400 5500

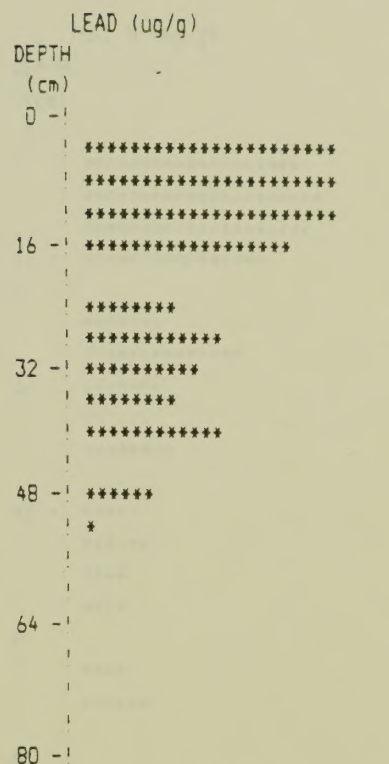
MOE G.L. (100 ug/g)



A A A A A A

0 200 400 600 800 1000

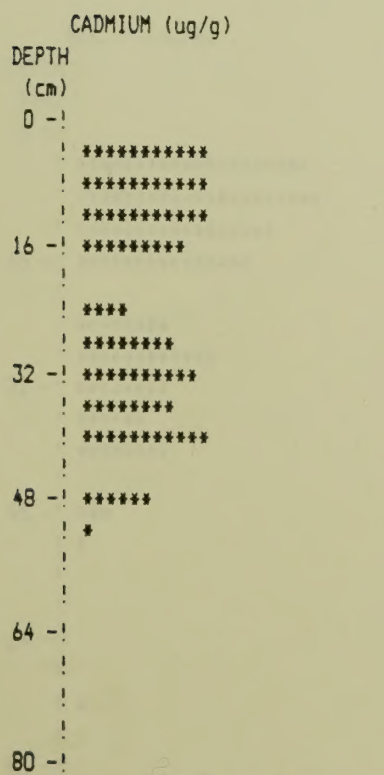
MOE G.L. (25 ug/g)



A A A A A A

0 250 500 750 1000 1250

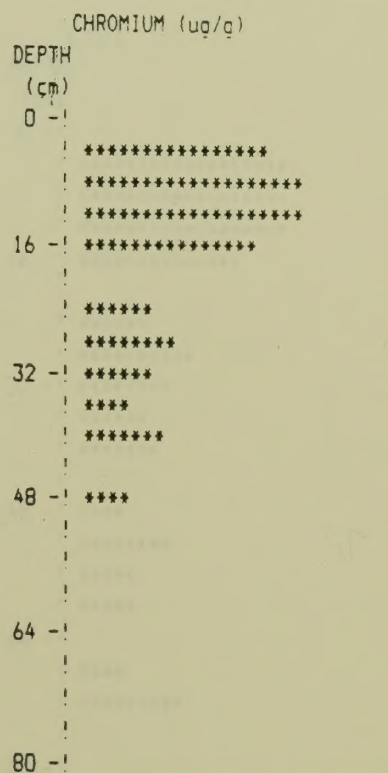
MOE G.L. (50 ug/g)



A A A A A A

0 8 16 24 32 40

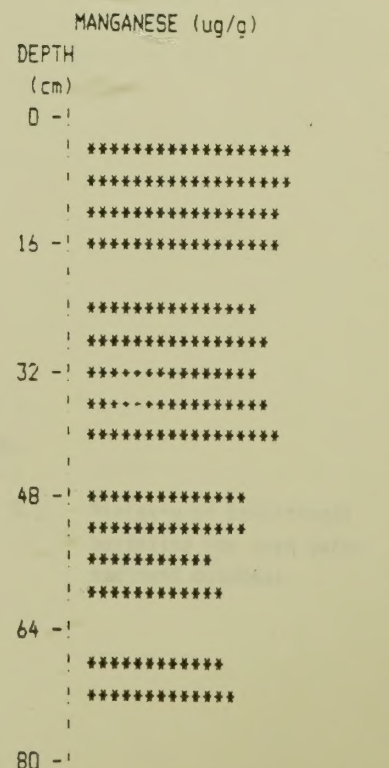
MOE G.L. (1.0 ug/g)



A A A A A A

0 500 1000 1500 2000 2500

MOE G.L. (25 ug/g)

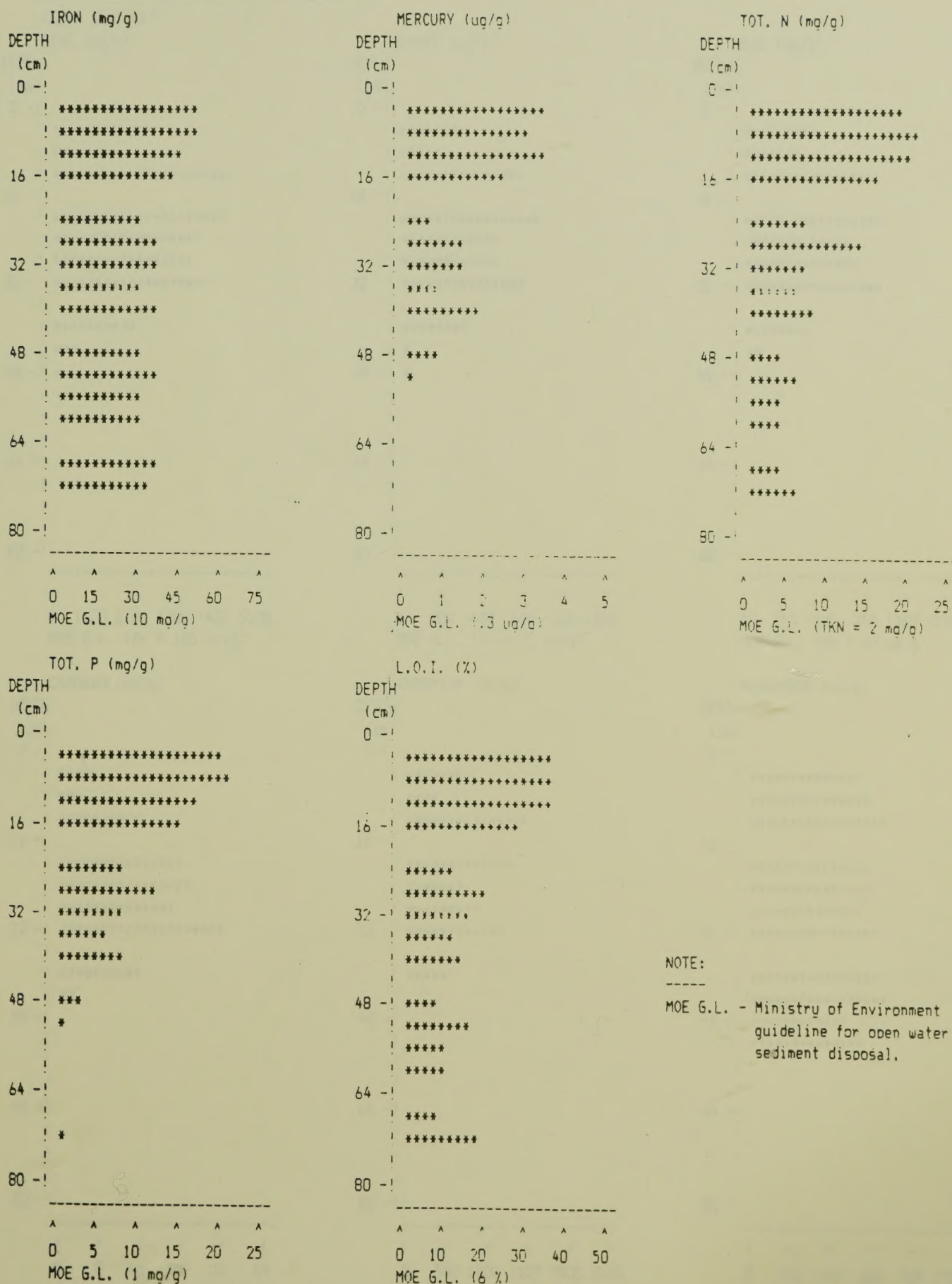


A A A A A A

0 200 400 600 800 1000

FIGURE 3 (cont'd)
WINDERMERE BASIN - SEDIMENT CORE SAMPLES

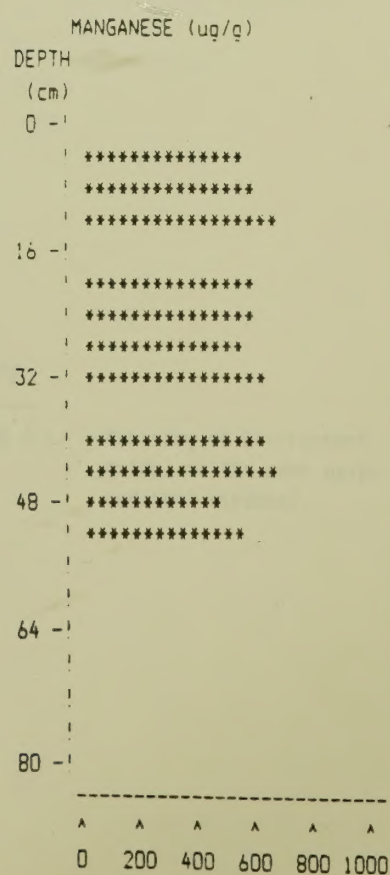
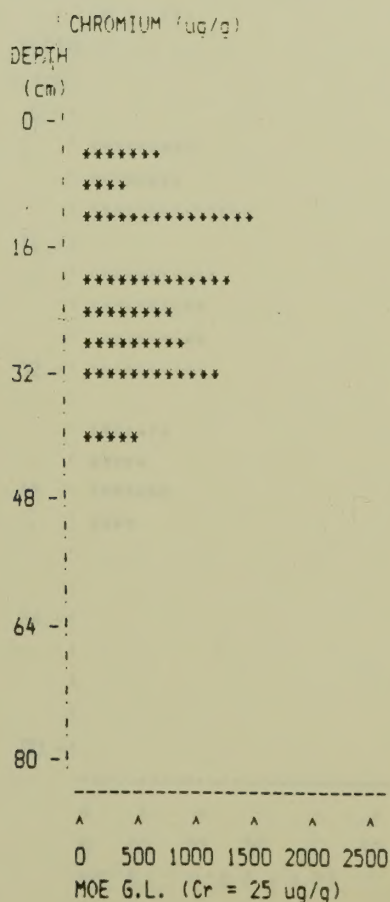
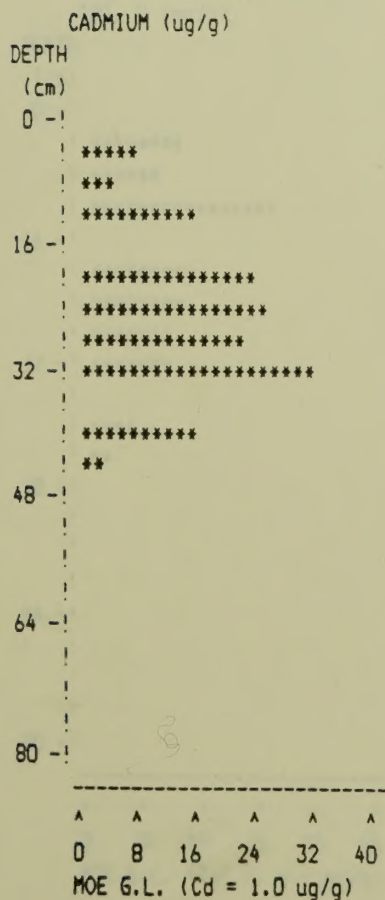
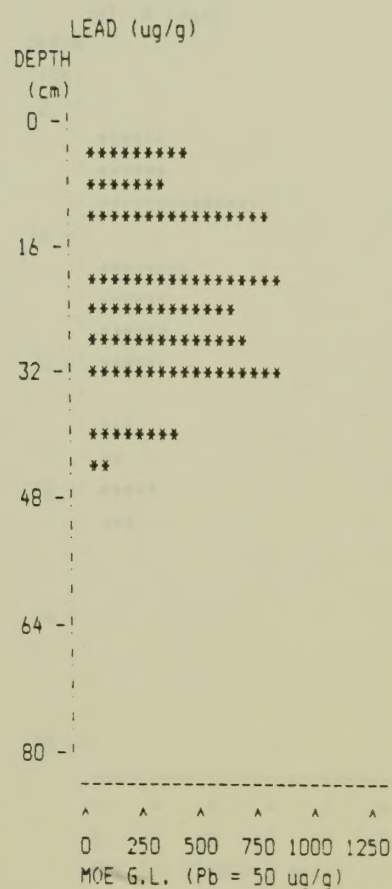
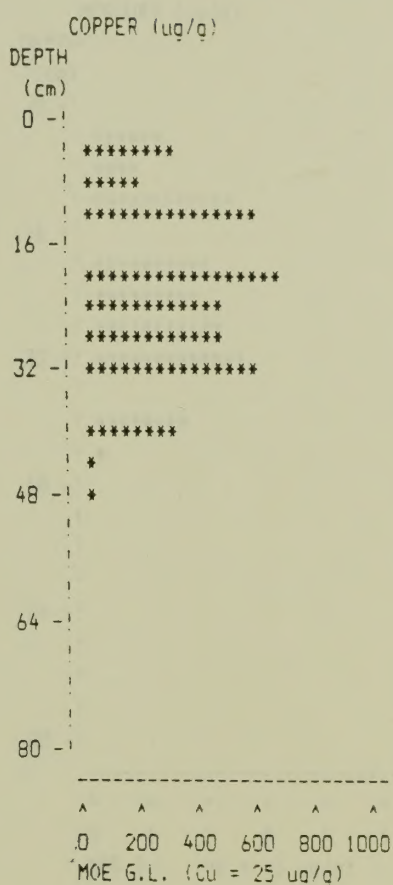
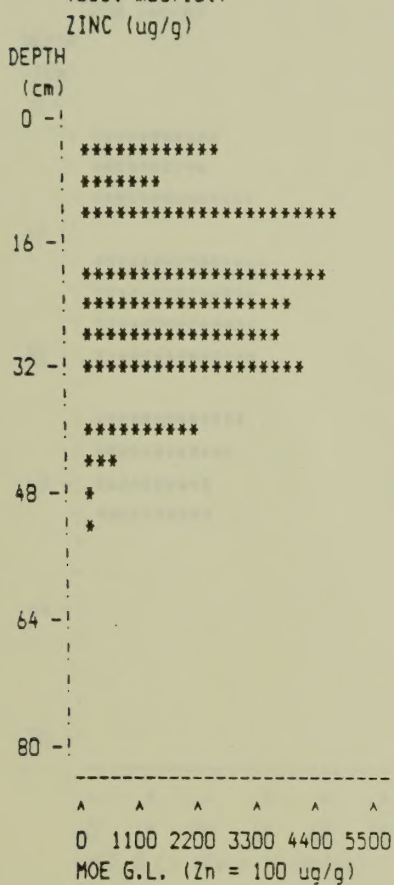
(CORE #: 2)



WINDERMERE BASIN - SEDIMENT CORE SAMPLES

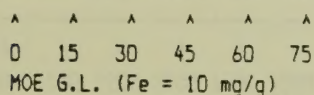
(CORE #: 3)

(west mudflat)



(CORE #: 3)

IRON (mg/g)



DEPTH
(cm)

0 - !
| *****
| *****
| *****

16 - !
| *****
| *****
| *****

32 - !
| *****

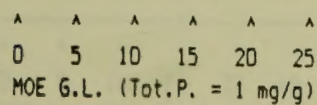
| ****
| **

48 - !
|
|
|

64 - !
|
|
|

80 - !
|

S



DEPTH
(cm)

0 -

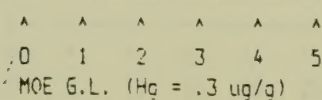
16 -

32 -

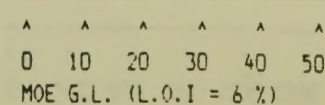
48 -

64 -

80 -



Depth (cm)	% WSOC
0	80
16	60
32	40
48	20
64	0
80	0



DEPTH
(cm)

0 -

16 -

32 -

48 -

64 -

80 -

MOE G.L. - Ministry of Environment
guideline for open water
sediment disposal.

FIGURE 5

WINDERMERE BASIN - SEDIMENT CORE SAMPLES

CORE #: 4)

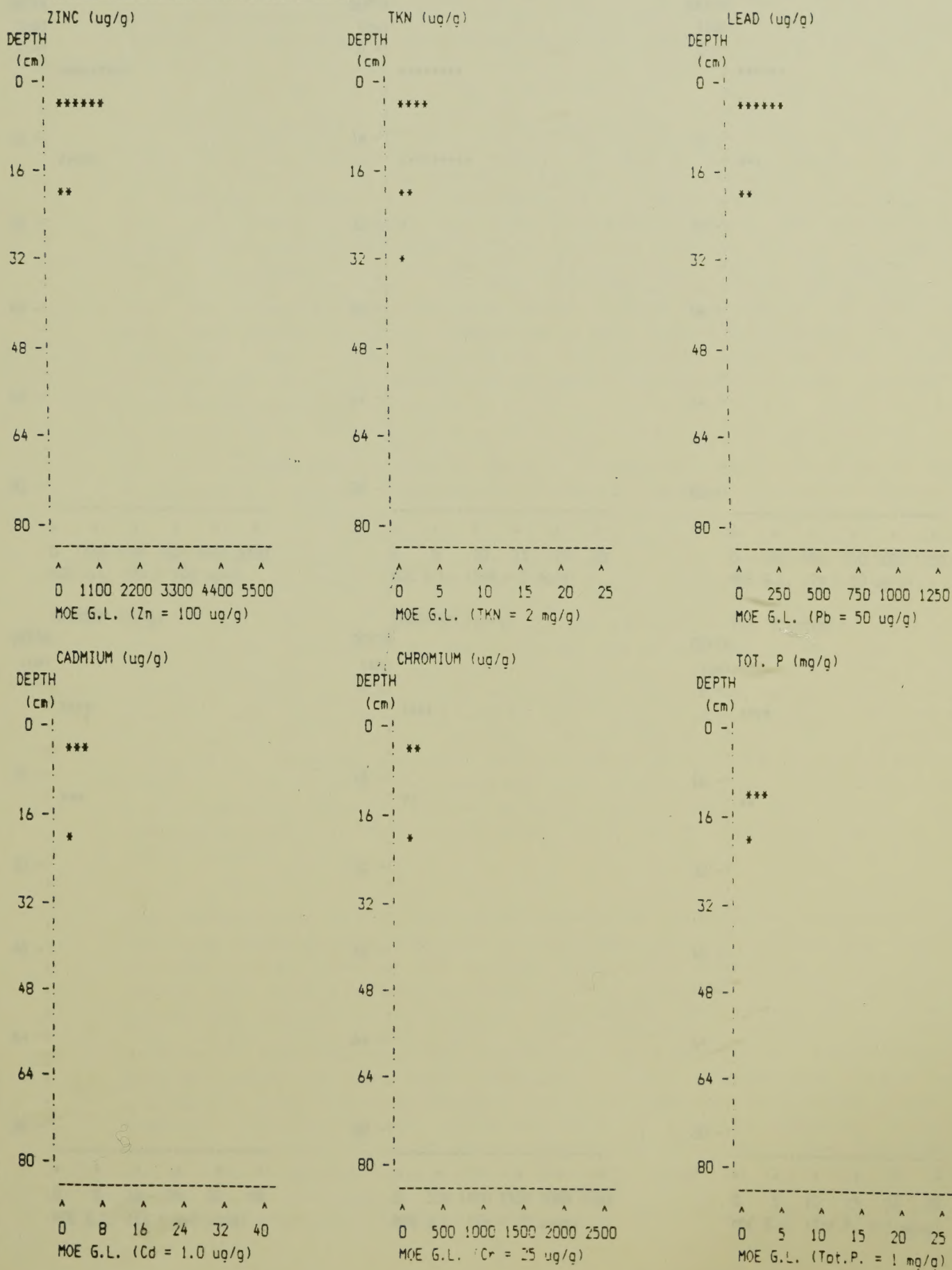
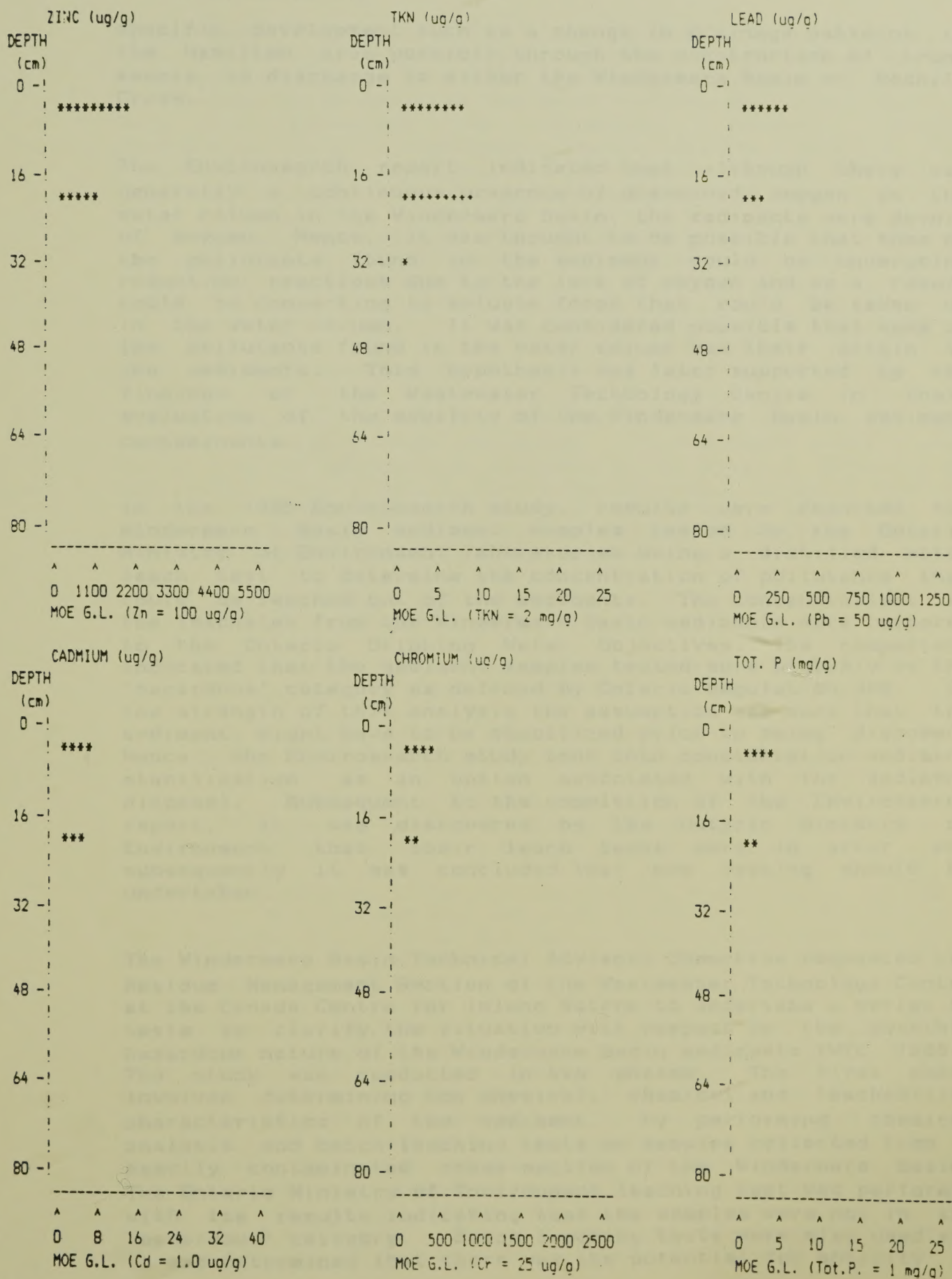


FIGURE 6
WINDERMERE BASIN - SEDIMENT CORE SAMPLES

(CORE #: 5)



specific development such as a change in drainage patterns in the Hamilton area possibly through the construction of trunk sewers to discharge to either the Windermere Basin or Redhill Creek.

The Envirosearch report indicated that although there was generally a continuous presence of dissolved oxygen in the water column in the Windermere Basin, the sediments were devoid of oxygen. Hence, it was thought to be possible that some of the pollutants found in the sediment could be undergoing reduction reactions due to the lack of oxygen and as a result could be converting to soluble forms that could be taken up in the water column. It was considered possible that some of the pollutants found in the water column had their origin in the sediments. This hypothesis was later supported by the findings of the Wastewater Technology Centre in their evaluation of the mobility of the Windermere Basin sediment contaminants.

In the 1985 Envirosearch study, results were reported for Windermere Basin sediment samples tested by the Ontario Ministry of Environment laboratories using a distilled water leach test to determine the concentration of pollutants that could be leached out of the sediments. The concentrations of the leachates from the Windermere Basin sediments were compared to the Ontario Drinking Water Objectives. The comparison indicated that the sediment samples tested were probably in the 'hazardous' category as defined by Ontario Regulation 309. On the strength of this analysis the assumption was made that the sediment might have to be stabilized prior to being disposed. Hence, the Envirosearch study took into consideration sediment stabilization as an option associated with the sediment disposal. Subsequent to the completion of the Envirosearch report, it was discovered by the Ontario Ministry of Environment that their leach tests were in error and subsequently it was concluded that new testing should be undertaken.

The Windermere Basin Technical Advisory Committee requested the Residue Management Section of the Wastewater Technology Centre at the Canada Centre for Inland Waters to undertake a series of tests to clarify the situation with respect to the possible hazardous nature of the Windermere Basin sediments (WTC 1986). The study was conducted in two phases. The first phase involved determining the physical, chemical and leachability characteristics of the sediment, by performing chemical analysis and batch leaching tests on samples collected from a heavily contaminated cross-section of the Windermere Basin. The Ontario Ministry of Environment leaching test was performed with the results indicating that the samples were not in the 'hazardous' category. Batch leaching tests were also used and it was determined that there was the potential for mobility of

contaminants (especially PCB's) in the sediments particularly when mixed with the overlying water as would occur during scouring resulting from high flow events or during dredging. The second phase involved lysimeter testing that indicated a very low potential for contaminant transport through groundwater from a confined disposal facility back to the Windermere Basin or Hamilton Harbour waters. The conclusion from the Wastewater Technology Centre testing was that:

"removal of sediment from the basin is justifiable and preferable to allowing the sediment to remain in their present condition".

2.3.3 Sediment Mobility

The probability of having sediments scoured relates to the velocity of flow through the basin. Envirosearch (1985) used bottom profile information provided by the Ontario Ministry of Environment to calculate the cross-sectional areas at several locations in the Basin. In turn, these areas were used to calculate average flow velocities through the basin under 5 test conditions. The conditions tested were:

- 1) the November 1983 water level (74.47 metres) with a flow of 3.925 cubic metres per second.
- 2) the average winter season Lake Ontario level (74.36 metres) with a flow of 3.925 cubic metres per second.
- 3) the average summer season Lake Ontario level (74.79 metres) with a flow of 3.925 cubic metres per second.
- 4) the average Lake Ontario level for the month of March (74.6 metres) with a flow of 20.0 cubic metres per second to represent a spring runoff condition.
- 5) the regional storm with Windermere Basin water levels at 76.0 metres and regional storm flow of 380 cubic metres per second assumed to pass through the Basin. The regional storm will represent a flow in excess of the 100 year storm.

The preceding conditions represent various situations that could be expected to occur. The flowthrough velocities for each location and each flow condition were calculated. The areas of the Basin were identified where the flow velocities were slow enough to permit solids to settle during periods of low flow, or fast enough to promote scouring during periods of high flow. To assess the probability of settling or scouring, the velocities were compared to levels generally accepted (MOE 1980) as threshold velocities to promote the settling or scouring of sediments. Threshold velocities used to determine the probability of sediment being scoured or deposited were:

- grit scours at velocity = 0.9 m/s.
- floc scours at velocity = 0.45 to 0.6 m/s.
- grit settles at velocity = 0.3 m/s.
- organics settle at velocity = 0.12 m/s (0.08 to 0.16)

The Envirosearch study found that under normal and low flow conditions, there are sections of the Basin with flowthrough velocities well below the assumed organic settling velocity of 0.12 metres/second. At the typical (normal) flow that was tested (3.925 cu. m/s.), there were no areas in the basin in which the sediment was likely to be scoured and sediment deposition was found to be likely to occur. Under high flows likely to occur during spring runoff or during major storm events there were sections of the basin that would scour. In particular, the narrow reaches of the basin near the inlet and the area around the mudflat were found to experience some scouring. Envirosearch found the probability of having scouring occur during a major storm event to be quite high.

The 1985 Envirosearch velocity profiles confirmed that the loss of sediment from the basin could be expected. As reported by Envirosearch, some sediment is likely to be scoured each year during periods of high flow. In the event of a major storm, the sediments are light enough and the velocities are high enough to promote the scouring of a significant amount of sediment. The sediments in the basin are quite mobile and prone to movement when subjected to the higher velocities that exist in the Windermere Basin.

A recent draft report (Ecologistics, May 1988), prepared for the Ontario Ministry of Environment as input to the Hamilton Harbour Remedial Action Plan, suggests that the future 'delivered sediment and phosphorus loading' for the Redhill Creek watershed could decline to in the order of 10% of the current loading. This would reflect changes in the watershed including the adaptation of conservation farming practices, streambank structural modifications, improved livestock control near watercourses and erosion control practices on construction sites. Much of the loading reduction projected for the Redhill Creek will result following the urbanization of the watershed over the next 20 years (as projected by Ecologistics Limited). A Region of Hamilton-Wentworth planner suggests that the Redhill Creek watershed is unlikely to be urbanized within the 20 year timeframe projected by Ecologistics. If this is the case, then the reduction in sediment and phosphorus loading rates will not be as great as predicted. A major concern arising from the Ecologistics report is the large increase in the rate of sediment loss during the initial construction activities as the watershed becomes urbanized. The Ecologistics report suggests increases ranging from 5 times to 200 times the current rate of sediment loss during the site preparation phases of construction activities commensurate with urban development. The current rate of sediment loss is in the

order of 26 tonnes per hectare in some areas of the Redhill Creek watershed. Without significant effort to limit sediment loss during construction, the sediment load on Windermere Basin could increase over the next 20 years as urbanization occurs.

2.4 EFFECT OF CONTAMINANTS IN WINDERMERE BASIN

The contaminants in the Windermere Basin have been shown to have an impact on the basin. In addition, studies undertaken by the Ontario Ministry of the Environment discuss the current patterns downstream from the basin. This section discusses the environmental impacts of Windermere Basin on the surrounding area.

2.4.1 Effect on Harbour Water Quality

The Ontario Ministry of Environment (1985) determined the retention time in the Windermere Basin to be 1 to 2 days depending upon the water height in the basin. In turn, the Windermere Basin discharges to the Strathearne Avenue Approach Channel of Hamilton Harbour (approximately 6.2 million cubic metres in volume) which represents in the order of 2.3% of the total Hamilton Harbour volume. Assuming complete dispersion in the Strathearne Avenue Approach Channel, the flows from Redhill Creek and the Woodward Avenue Sewage Treatment Plant would stay in the Channel 21 days. The report (MOE 1985) states that:

"Generally the flow from the channel is directed towards the Burlington Canal, but some of the flow is mixed into the main body of the harbour before flowing through the canal."

This implies a short circuiting of flow toward the Burlington Canal. Pollutants dissolved or suspended in the water column leaving Windermere Basin could be discharged via the Burlington Canal to the western end of Lake Ontario.

The 1985 Envirosearch report suggests that if the uptake of contaminants from the sediments in the Windermere Basin did not occur, the water quality at the outlet from the basin would be significantly better than the incoming quality from Redhill Creek and the Woodward Avenue Sewage Treatment Plant.

The Wastewater Technology Centre 1986 report, confirmed the ability of contaminants in the sediment to migrate via the water column if the sediments are mixed with the overlying water. The recommendations from the Wastewater Technology Centre favoured the removal of Windermere Basin sediments from

their current contact with the overlying water and the placement of the sediments in a confined disposal area.

The Hamilton Harbour Technical Summary and General Management Options (August 1985) pointed to the Woodward Avenue Sewage Treatment Plant as a major source of phosphorus and nitrogen enrichment of the Hamilton Harbour. The report also stated that:

"the harbour is still a prime area of concern in the Great Lakes (IJC 1984). One of the largest factors contributing to the harbour's present state is the level of contamination of the sediments".

The preceding comment would apply to the Windermere Basin sediments as well as the actual harbour sediments.

2.4.2 Effect on Western Lake Ontario Water Quality

The Ontario Ministry of Environment 1986 report 'Impact of Hamilton Harbour on Western Lake Ontario' (Poulton et al.) discussed the impact of the pollutants in Hamilton Harbour on Lake Ontario water quality. The report states:

"During summer (August) when the harbour is stratified, water chemistry data (nutrients, water clarity, heavy metals) show higher concentrations for parameters such as ammonia, total Kjeldahl nitrogen, total phosphorus, chloride, turbidity, suspended solids, iron and manganese in outflowing waters of the canal, compared to a central harbour sampling location. This suggests the possibility of more direct outflow of industrial and municipal effluents from the southeastern part of the harbour to the canal, without the usual residence period".

The above supports other findings that there is short circuiting of discharges from the Windermere Basin to Lake Ontario.

The above report also described findings of field surveys that indicate that the contaminated waters from the harbour do, on occasion, impact the water quality around both the Burlington and Hamilton water intakes in Lake Ontario. This conclusion is as a direct result of water quality measurements taken on two separate occasions. The report stated that:

"Although average water chemistry data at the Hamilton and Burlington Water Treatment Plant (WTP) intakes are not significantly different from those measured at lake background locations, occasional high results were

found at the intakes for nutrients (N and P), heavy metals and turbidity. Burlington WTP results assessed in conjunction with plume survey data suggest impingement of the harbour plume on one survey date, while for another date, plume data suggest impingement at the Hamilton WTP intake...".

The above findings demonstrate the potential to have short circuiting of flow from Windermere Basin to Lake Ontario via the Burlington Canal and the potential to have flow from the Burlington Canal impact the Hamilton and Burlington water intakes.

2.4.3 Effect on Flora and Fauna Including Fish and Waterfowl

Varying opinions have been expressed as to the significance of the contaminants within Windermere Basin with respect to their impact on the population of benthic organisms.

The Ontario Ministry of Environment report The In-Place Pollutants Program - Volume III - Phase 1 Studies (Persaud et al. 1987) stated that sediments in Windermere Basin were heavily contaminated and appeared to be toxic to biota. The findings in this study were based on a limited sample size.

More recent findings by Dobos and Weseloh of the Canadian Wildlife Service (Dobos 1987) contradict Persaud. The latter investigators have found nutrient rich sediments that contain large numbers of benthic invertebrates that support some aquatic submergent vegetation that is an important food sources for waterfowl in Windermere Basin.

A number of deaths occurred in the wild duck population using Windermere Basin during the fall/winter period of 1985-86. Flightless Pekin ducks subsequently placed in the basin accumulated PCB residues almost 50 times greater than ducks at other locations (RAP, 1988). These ducks also developed health problems and showed signs of lead poisoning from unknown sources. In the fall of 1987, wild ducks resident in the basin became infected with botulism. The conditions in the Windermere Basin were seen to be right for the survival of botulism although the botulism problem was not confined to Windermere Basin.

A population of waterfowl and shore birds have established in Windermere Basin. Waterfowl surveys conducted by the Canadian Wildlife Service during 1986 and 1987 (Dobos 1987) report populations of waterfowl in the 1800 to 4700 range.

Windermere Basin was historically a marsh area with habitat for fish including spawning areas. The present condition of the basin is such that there is a low fishery rehabilitation potential.

Fish populations in the Windermere Basin include limited populations of Carp, or species that are relatively pollution tolerant. It is anticipated that during any dredging operation conditions will arise that will kill any fish trapped in the area of the Basin being impacted by the dredging.

Other wildlife species reported in the Basin include turtles and aquatic mammals that reside along shore areas of the Basin.

2.5 AESTHETICS OF THE WINDERMERE BASIN AREA

Prior to the land reclamation program instituted in the 1950's, the Windermere Basin was an open water area at the eastern extremity of Hamilton Harbour. The area included a significant area of marshes and related wetlands. As the Windermere Basin was enclosed, sedimentation was accelerated along with the deposition of contaminants including metals and PCB's. At the same time, the surrounding land use became more industrial. The open nature of the area changed with the last remaining open space being the waters of the Windermere Basin.

This sequence of events can be tracked in the sediment deposits in the basin. Sediment sampling conducted by the Ontario Ministry of Environment as part of the 1982 Windermere Basin Study confirms that the basin supported vegetation as evidenced by the discovery of a root mat located in the sediments at a depth in the order of 65 centimetres below the surface of the existing sediment.

Over time, the Basin has evolved from an open water area in the eastern part of the harbour to a shallow waterbody covered with a layer of grossly contaminated sediments.

Due to the fluctuation in the water level of Lake Ontario and the related changes in the water level of Hamilton Harbour, large deposits of sediment are regularly exposed in the Windermere Basin. These exposed sediments form mudflats that contain a variety of entrained debris that detracts from the aesthetics of the basin. The location of the basin adjacent to the Queen Elizabeth Highway at one of the principal access points to the City of Hamilton makes the basin a high profile setting.

2.6 PUBLIC CONCERNS AND PERCEPTIONS OF WINDERMERE BASIN

Several projects have been initiated to enhance the Hamilton Harbour environment. The Hamilton Waterfront Development Project initiated by the City of Hamilton will convert a former harbour fill site in the southwest portion of the harbour into an island recreational development. Improved industrial and municipal waste treatment and the clean-up of the Desjardin Canal in Dundas have contributed to improved water quality in Hamilton Harbour and Cootes Paradise. The recent effort to develop a Remedial Action Plan (RAP) for the harbour has brought together a cross-section of harbour users to discuss plans for further improvements in the harbour. The RAP report addresses the need to proceed with improvements to Windermere Basin which the public sees as a part of the Harbour. Consequently, considerable public interest has been aroused. Public opinions are now being strongly expressed as to the need for a clean-up of the Windermere Basin. While there is agreement as to the need for a clean-up, there is concern that the clean-up be undertaken with care to avoid further environmental contamination from the polluted sediments.

An article in the June/July 1987 edition of the Canadian Geographic magazine features the efforts underway to clean-up Hamilton Harbour. This article illustrates the interest and timeliness of environmental enhancement projects in the Hamilton environs.

2.7 IMPORTANCE AND URGENCY TO RESOLVE PROBLEM

The Remedial Action Plan for Hamilton Harbour, March 1988, recommends that the clean-up of Windermere Basin "be considered separately from and proceed in advance of the overall Harbour RAP".

The possibility of sediments being scoured from the Windermere Basin and carried through to Hamilton Harbour or Western Lake Ontario could result in environmental degradation. In view of the findings of previous studies that some contaminated sediments are routinely scoured from the Windermere Basin bottom deposits and discharged to the Strathearne Avenue Approach Channel, it follows that a definite risk exists that some environmental degradation can be expected to occur regularly in Hamilton Harbour as a result of the scouring of sediment from the Windermere Basin.

Under existing conditions it is possible to have a series of events involving a major storm that could result in polluted

sediments being flushed from the Windermere Basin and carried into Hamilton Harbour.

In addition to the threats to water quality in the harbour, there is the hazard that is posed to waterfowl that use the Windermere Basin. Several hundred waterfowl deaths have recently occurred in the populations of waterfowl that use the Windermere Basin.

Summary comments from the Ontario Ministry of Environment, 1985 report - Hamilton Harbour Technical Summary and General Management Options identify the problem. The report states that:

"One of the largest factors contributing to the harbour's present state is the level of contaminants of the sediments. Present inputs from the point sources continue to provide an environmental stress which cannot be assimilated by the harbour ecosystem".

Although the report addresses the overall Hamilton Harbour situation, the findings are also pertinent to Windermere Basin. The report identified a series of management options for the harbour which specifically included the "dredging of Windermere Basin".

It is not possible to predict when or if the storm conditions will arise that could scour sediments from the Windermere Basin and cause serious environmental problems. This uncertainty adds to the element of urgency to undertake a clean-up of the Windermere Basin in order to reduce the existing environmental risk associated with the 'in situ' contaminated sediments.

The most important consideration is that the volume of Windermere Basin is now reduced to the degree that there is little room remaining to trap sediment and pollutants being discharged to the basin. As a consequence, sediment discharging to the basin will either pass through to Hamilton Harbour, or displace contaminated sediment already in the basin which in turn will pass into the harbour. The situation will not improve with time.

The existing information supports a conclusion that the clean-up of Windermere Basin would definitely benefit the basin and the adjoining waters of Hamilton Harbour.

The conclusion of the Windermere Basin Technical Advisory Committee as to the need to clean-up the Windermere Basin is supported by the findings of the Wastewater Technology Centre

investigations, by the 1985 Envirosearch study, by the Remedial Action Plan investigations and by the Ontario Ministry of Environment studies.

The following table summarizes the results of the investigations conducted to date.

The following table summarizes the results of the investigations conducted to date.

ENVIRONMENTAL IMPACT STUDY

The following table summarizes the results of the investigations conducted to date.

The following table summarizes the results of the investigations conducted to date.

The following table summarizes the results of the investigations conducted to date.

The following table summarizes the results of the investigations conducted to date.

The following table summarizes the results of the investigations conducted to date.

2.1.1 On-Site Disposal

The Envirosearch report (1985) considered the need for a disposal site for contaminated materials from the plant. It noted that the plant had a large amount of waste material and that this material was being disposed of in a number of ways. The report recommended that the plant should have a dedicated disposal site for this material. The report also noted that the plant had a large amount of waste material and that this material was being disposed of in a number of ways. The report recommended that the plant should have a dedicated disposal site for this material.

3.0 ALTERNATIVES CONSIDERED TO SOLVE WINDERMERE PROBLEM

The report prepared by Envirosearch Limited (1985) for the Windermere Basin Technical Advisory Committee considered the following alternatives for the clean-up of Windermere Basin:

- do nothing
- partial dredging
- create marsh
- combination of above.
- complete dredging
- raise water level with dam
- channelize and fill

The alternatives, which involve either leaving the contaminated sediment in Windermere Basin in some form, dredging the sediments and placing dewatered sediment in a landfill or incinerating dewatered sediment at the Woodward Avenue Sewage Treatment Plant are discussed in detail below. Various sediment disposal alternatives that were considered for each of the clean-up alternatives are presented first.

3.1 SEDIMENT DISPOSAL TECHNIQUES

The disposal techniques that were considered to warrant further consideration for the Windermere Basin sediments included:

- 1 - On-site disposal in which a containment area would be created within a portion of Windermere Basin.
- 2 - Dewatering of sediments and the transporting of the dewatered sediments to a landfill.
- 3 - Dewatering and incineration of the sediments at the Woodward Avenue Sewage Treatment Plant. The organic sediments would be digested and incinerated. Inorganic gr. would be separated and disposed with other grit from the sewage treatment process.

The following sections further discuss these techniques.

3.1.1 On-Site Disposal

The Envirosearch report (1985) considered the most likely alternative for a disposal site for contaminated sediments from Windermere Basin to be the creation of a dyked disposal area within a portion of the Basin. It was accepted that the reduction of surface area in the Basin to create a containment area could reduce the potential surface oxygen transfer capacity. However, the related reduction in sediment oxygen demand could offset the need for the additional surface re-aeration capacity. The potential benefit from removing the

contaminated sediment in the basin from the 'Redhill Creek - Hamilton Harbour - Lake Ontario' environment was seen to offset the loss of re-aeration capacity potential. The development of a containment area within the basin was seen to be an environmentally acceptable tradeoff in order to isolate the contaminated material from the aquatic environment.

The Envirosearch report (1985) considered the possible need for chemical stabilization to treat the sediments so that the contaminants would be bound up in an impermeable soil cement. The Ontario Ministry of Environment data that had previously indicated that the Windermere Basin sediments were probably hazardous had generated concern that contaminants might be leached from the containment area unless the sediment was chemically fixed as proposed by Envirosearch.

One drawback that was identified with the chemical stabilization of contaminated sediments was that the end volume of the material to be disposed would be approximately doubled. Hence, a significantly greater capacity might be required in the containment area. The available information suggested that the nature of the stabilized sediment was such that, it would not necessarily require that a greater water area be taken from the basin to dispose of the sediments that would have to be removed. It was considered that the stabilized sediment might be used to create above ground screening berms similar to the berms used around quarry operations. This could facilitate the development of a visual screen that, in association with a landscaping program, could hide much of the National Slag and Stelco industrial operations. The cost of stabilizing the sediment and creating the berm disposal areas were high compared to a conventional confined disposal area. As a result of the higher cost, and in view of the suitability of the basin sediments for conventional confined disposal, the sediment stabilization option was rejected.

The prefeasibility design concept proposed by Mar-land (1984) pointed to the possibility of numerous configurations that could be developed for creating containment areas to dispose of contaminated sediment from Windermere Basin. Mar-land suggested that conventionally designed dredged spoil containment areas could be utilized such that 50% of the Basin area could be maintained in open water (approximately 20 hectares).

The Envirosearch report (1985) favoured the development of a containment area within the Basin in that such an approach would have a much higher probability of success than the development of other disposal alternatives. Cost estimates for the development of a containment area involving the construction of berms and the dredging and disposal of the dredge spoils behind the berms were estimated to range from

\$3.75 to \$7.0 million depending upon whether or not dewatering and chemical stabilization of the sediment was utilized.

3.1.2 Dewater Sediment and Transport to a Landfill

The Envirosearch report (1985) presented one scenario whereby the sediment would be removed from Windermere Basin, dewatered and the solids portion of the material hauled to a landfill. The report suggested the use of 2-metre belt filters similar to the type used to dewater sludge in sewage treatment facilities. It was projected that the 2-metre filters could process approximately 1,800 kilograms of dry solids per hour per filter.

The quantity of contaminated sediment was estimated to be equivalent to 80,000 tonnes of dry solids. Assuming that the sediment dewatering operation would be undertaken in association with a landfill disposal alternative, the equipment would most likely be located adjacent to Windermere Basin. The report projected the need for 4 filter units working two shifts per day from May to October over a period of 7 years to dewater the sediment. Dewatered sediment would then have to be hauled to a landfill.

Subsequent Wastewater Technology Centre testing indicated that the dewatered sediment is non-hazardous. Therefore, it should be suitable to be landfilled at Taro Properties Inc. in Hamilton or Walker Brothers Quarries Ltd. in Niagara. The Hamilton-Wentworth Glanbrook landfill is restricted in the type of materials that can be landfilled. Alternatively, sediment could be disposed at approved landfills in New York State or possibly Sarnia. The latter sites were originally considered before it was discovered that the Ontario 'hazardous' test results were in error.

The cost of dewatering sediment was estimated to be approximately \$80.00/tonne of dry solids. At 80,000 tonnes of dry solids, the dewatering cost would be in the order of \$6.4 million.

In addition, the cost of trucking would have to be included to move the dewatered sediment to an appropriate landfill. At a haulage rate of \$2.50 per tonne per 10 kilometres, the cost to move 250,000 tonnes of dewatered sediment (ie. 80,000 tonnes of dry solids if only dewatered to 30% moisture content) would be in the order of \$63,000 (\$1985) per kilometre of haulage distance.

Haulage costs for disposal sites at various locations were estimated (\$1985) as follows:

- Taro (32 km) \$ 2.0 million
- Sarnia (225 km) \$14.2 million
- Niagara Falls, N.Y. (90 km) \$ 5.7 million

The actual landfill cost which must also be included could be in the order of \$50.00 per tonne, which at 250,000 tonnes would cost \$12.5 million. The cost of dredging would be in the order of \$2.0 million. The total estimated cost of dredging, dewatering and trucking to landfill, could be in the order of \$22.9 to \$35.1 million. In addition to the high cost factors, there was also the consideration of the high volume of truck traffic that would be generated in hauling the dewatered sediment to a landfill. This traffic would create an environmental hazard should any material be spilled, plus there would be safety risks created for people using the truck haul roads.

3.1.3 Dewatering and Incineration of Sediments at the Woodward Avenue Sewage Treatment Plant

Sediment removed from Windermere Basin could be pumped to the Woodward Avenue Sewage Treatment Plant and processed through the plant. The inorganic grit solids would be separated at the pretreatment facilities and the organics solids would be separated with the other sewage solids and digested. The digested sludge would then be dewatered and incinerated. The ash would be disposed with the ash from the sewage solids.

One possible problem is the high levels of phosphorus in the Windermere Basin sediment. Currently, the Woodward Avenue Sewage Treatment Plant produces an effluent with over 1 mg/L of phosphorus. Efforts are underway to reduce the phosphorus in the effluent to acceptable levels. If the current efforts are not successful, the plant may have to be upgraded with additional equipment. If the Windermere sediment is treated at the Sewage Treatment Plant the high levels of phosphorus in the sediment would probably cause the phosphorus levels in the effluent to rise such that there could be a potential violation of the 1 mg/L International Joint Commission requirement which, in turn, could place the plant in violation of the Canada-U.S. water quality agreement.

There is space at the Woodward Avenue Sewage Treatment Plant to install 4 belt filters similar to the units discussed in section 3.1.2. Making the assumption that the filters could be operated in the sewage treatment plant with limited down time for maintenance, the dewatering of the sediment could take as little as 3 years. However, due to additional constraints

imposed by the dredging operation the time required would more likely be 4 to 5 years.

The existing incineration facilities at the Sewage Treatment Plant can process the additional sediment volume that would be produced by four extra filters.

The incremental cost of dewatering and incinerating the sediment at the Woodward Avenue Sewage Treatment Plant was calculated to be \$100.00 per tonne of dry solids. To incinerate 80,000 tonnes the cost would be \$8.0 million (\$1985). If a significant portion of the Windermere sediment is categorized as grit, then a larger percentage would be removed at the pretreatment phase. This would increase the pretreatment cost but reduce the incineration cost. Depending upon the percentage of the sediment that is grit, there could be some savings in the estimated \$8.0 million incineration cost.

There would also be the cost of dredging to be included as per the section 3.1.2 estimate of \$2.0 million.

The total estimated cost of dredging, dewatering and incinerating the sediment at the Woodward Avenue Sewage Treatment Plant is \$10.0 million (\$1985).

3.2 WINDERMERE BASIN CLEANUP ALTERNATIVES

Each of the alternatives indicated in section 3.0 were studied with consideration given to the positive and negative benefits that would accrue from implementing the alternative.

Options that involve the movement of sediment dictate that consideration be given to both the prevention of undue contamination of the aquatic environment during the removal process and the disposal of the sediment in some environmentally acceptable fashion. Each alternative that has been considered is discussed below with the findings of the various studies being presented. This is the background upon which the Windermere Basin Technical Advisory Committee based its conclusions.

3.2.1 Do Nothing

Sedimentation has occurred in Windermere Basin such that for

extended periods of each year, large areas of the Basin are exposed mudflats. At other times of the year, when water levels in Lake Ontario and Hamilton Harbour rise, the depth of water in the Basin covers the mudflats, leaving the impression of an open waterbody. If the 'do nothing' option is accepted, this cycle will continue, with the mudflat area increasing with time until a progressively larger area of the basin is exposed at low water levels.

The long term implications of a 'do nothing' option are unknown. Presumably, if the option is pursued indefinitely, it is possible that the mudflats could eventually support cat-tails or some other species of aquatic plant and the basin could evolve toward a marsh environment. In view of the very light density of the sediments in the mudflats and the significant fluctuations in the water levels, it is possible that aquatic plants might not become established and as a consequence, the natural conversion to marsh could take considerable time to occur. The absence of growth at this time could also be indicative of toxic conditions that would continue to impede aquatic plant development.

a) Environmental Concerns

The most significant environmental concern associated with the 'do nothing' option is that portions of the highly contaminated sediments in the Windermere Basin are being scoured each year by high flows such as those occurring during spring runoff or major storm events. The quantity of contaminated sediment that is scoured each year under these conditions is limited, however, a significant portion of the sediments in the Basin could be scoured by a major storm event such as a 'Regional Storm'. If this were to occur, contaminated sediments that are currently in the basin could be flushed into Hamilton Harbour and possibly to Lake Ontario where they could have an impact on water quality or fish and aquatic life. There is no way to predict when such a severe storm might occur.

Another environmental concern is that wildlife, including the waterfowl that now frequent Windermere Basin are being exposed to levels of pollutants that could affect the health of these species. Since the 1985 Envirosearch report, incidents have occurred whereby the resident duck population has been poisoned. Post-mortems on birds indicate that some contaminants known to occur in the Windermere Basin sediments have accumulated in the birds.

The continued presence of the contaminated sediments in Windermere Basin will also mean that there is the ongoing risk of uptake of various metals and contaminants in the water column. The Envirosearch analysis of water quality data for

the Basin and the Wastewater Technology Centre (1986) report both support this hypothesis.

The information available at this time supports the conclusion that there is considerable environmental risk associated with doing nothing and leaving the Windermere Basin sediments in situ.

b) Environmental Benefits

The long term environmental benefits from Windermere Basin will continue to decline if the contaminated sediments in the basin are not isolated from the environment. In its present form, the basin affords some benefit by providing a limited assimilation of the oxygen demanding substances associated with the treated effluent being discharged from the Woodward Avenue Sewage Treatment Plant. If nothing is done, the basin will continue to fill with sediment until it is effectively filled in and channelized. The majority of the existing limited assimilation benefit will eventually disappear. In its present condition there is some environmental benefit accruing from Windermere Basin although it is definitely limited and declining with time.

c) Aesthetic Considerations

Assuming the continuation of a 'do nothing' option, there is little aesthetic value that can be credited to the Windermere Basin.

During the summer months, when water levels are high, at first glance the Basin looks like an open water body, however, a closer look identifies debris around the shoreline and in some areas tree stumps, rubber tires and other refuse protruding from the water.

At times of the year when Lake Ontario water levels are low, the mudflats are exposed and the basin has even less aesthetic appeal.

d) Costs

The 'do nothing' option requires no expenditure of dollars to be incurred at this point in time. Assuming that an environmental contingency does not occur and the environmental hazards discussed previously can be tolerated, the 'do nothing' option will continue to have no dollar cost. However, if sediment continues to accumulate in the basin the eventual correction of the problem will cost more than if the problem is addressed

now by removing the contaminated sediments from the Windermere Basin. From the viewpoint of downstream navigation, doing nothing to clean-up Windermere Basin could result in additional sediment being transported downstream with a resultant cost occurring for the removal of sediments from the Strathearne Avenue approach channel.

e) Socio-Political Considerations

There is an increasing interest on behalf of Hamilton area residents to see something done to improve the appearance of Windermere Basin. The public disapproves of the image of the Hamilton area that is created by Windermere Basin in its present state. Current moves to promote a 'Beautify the Harbour Concept' indicate an interest on behalf of the population to see the correction of conditions such as those in Windermere Basin.

The local, regional, provincial and federal levels of government and their associated agencies have all expressed a desire to see a Windermere Basin clean-up occur. The various levels of government have also taken the step of committing funds to the present Windermere Basin clean-up project.

The interest expressed by residents and the actions taken by the various government agencies serve as a strong statement against a 'do nothing' approach to the Windermere Basin.

3.2.2 Complete Dredging and Off-Site Disposal or Incineration

'Complete Dredging' involves the removal of sediments from the bottom of the basin along with some form of sediment disposal such that the surface area of the basin is not reduced. This alternative would maintain the maximum water surface within the basin, remove the contaminated sediments, provide sediment trap capacity and increase the assimilation capacity of the Basin.

The major drawback with the alternative is that the sediments removed from the Basin would require some form of off-site confined disposal facility. In view of the level of metals and PCB contamination in the sediments, any disposal facility would likely be opposed by neighbours. Approval for such a disposal facility would be difficult to obtain. Alternatively, any treatment such as incineration would have to be capable of destroying or containing compounds such as PCB's or heavy metals.

a) Environmental Concerns

The major concern associated with this alternative is the loss of contaminants to the aquatic environment during the dredging and disposal processes. This could occur both as a result of sediment losses from around the dredge and from the discharge of contaminated decant water from the sediment treatment area.

There is also the concern that wildlife could be exposed to pollutants in the sediment disposal area prior to final capping.

b) Environmental Benefits

The hydraulics of flow through Windermere Basin would be improved. This would provide an opportunity to create a sediment trap in the basin that could reduce the need for maintenance dredging further downstream in the approach channel to the Strathearne Avenue slip and in the areas adjacent to the East Port pier facilities.

The removal of the contaminated sediments would reduce the risk of pollutant resuspension into the water column, thereby reducing the risk of discharging these materials to Hamilton Harbour or possibly to Lake Ontario.

The assimilative capacity of the Basin would be increased if dredging were undertaken and the sediments having a high sediment oxygen demand were removed. This could provide some additional benefit in the form of post discharge aeration and suspended solids removal for the effluent from the Woodward Avenue Sewage Treatment Plant prior to its discharge to Hamilton Harbour.

c) Aesthetic Considerations

The removal of the sediments from the Basin could eliminate the exposure of mudflats during periods of low water levels. This would maintain the 'waterbody' appearance of the Basin and provide an enhanced aesthetic appeal.

d) Costs

The 'complete dredging' option would require the expenditure of a significant sum of money both for the dredging portion of the work and for the disposal of the contaminated sediments. Depending upon where the sediments were to be disposed and what process was to be used, the sediment disposal aspect of the project could become the largest expenditure.

The complete dredging of Windermere Basin would remove the contaminated sediments from the Basin. Even though these sediments have been tested and found to be non-hazardous, it would still be difficult to establish a suitable off-site disposal area. As discussed previously, there are existing private landfills including the Taro Properties Inc. landfill north of Hamilton and the Walker Bros. Quarries Ltd. landfill in Niagara that could take the sediment. However, the owners might not wish to accept the large volumes involved in this clean-up. The major problem relates to the cost of dewatering the sediment and both the logistics and cost of moving such a large quantity of material by trucks. Another problem with this option is the high cost of the landfilling fees. The rate at which sediment can be dewatered could force the project to be spread over as many as seven years. As discussed previously, the cost of dredging, dewatering sediment, trucking to a landfill and tipping sediment is estimated to be in the order of \$22.9 to \$35.1 million (\$1985).

Assuming that the dredging of the Basin could be undertaken such that the sediment could be treated at the Woodward Avenue Sewage Treatment Plant, the organic portion of the sediments could then be incinerated. This alternative would substantially reduce the cost of trucking and landfill fees, however, energy costs for the incineration process would have to be added to dewatering costs. As discussed previously, a major problem would be that the project could take several years to complete because of limitations posed by the dewatering process. The cost of dewatering and incinerating the sediment at the Woodward Avenue Sewage Treatment Plant has been estimated to be in the order of \$10.0 million (\$1985).

e) Socio-Political Considerations

The 'complete dredging' option complements the expressed desires to clean up the Windermere Basin. However, if the disposal of sediments involves off-site trucking, processing or landfilling, it is anticipated that the project could become embroiled in a "Not in My Back Yard" syndrome. The solution to the Windermere problem could then result in the creation of a second and possibly more volatile public concern with respect to the development of an acceptable disposal facility.

3.2.3 Partial Dredging and Fill

Partial Dredging and Fill involves the removal of sediments from the bottom of a portion of the basin with a sediment disposal area created in adjacent portions of the basin. The sediment disposal area could be sized to permit the disposal of all of the dredged sediment with some additional capacity for future maintenance dredging. The disposal area would be

designed to prevent contaminants in the sediment being leached from the confinement area.

a) Environmental Concerns

The major concern associated with this alternative is the loss of contaminants to the aquatic environment during the actual dredging and disposal processes. This could occur both as a result of sediment losses from around the dredge and from the discharge of contaminated decant water from the sediment disposal area.

The dredged material will be placed in the sediment disposal area to an elevation of approximately 75.9 metres before settling takes place. This is 1.0 metres above the summer high water level. The dredged material will be placed in the disposal area during 1988 and 1989 following which it will be left to dewater until the winter of 1990 when it will be capped while there is frost in the surface layers of the material. During this period the disposal area will be exposed to the atmosphere prior to final capping. There could be a hazard for wildlife including waterfowl during the period following the dredging activities and prior to the capping operation.

b) Environmental Benefits

The hydraulics of flow through Windermere Basin would be improved. This would provide an opportunity to create a sediment trap in the basin that could reduce the need for maintenance dredging further downstream in the approach channel to the Strathearne Avenue slip and in the areas adjacent to the East Port pier facilities.

The removal of the contaminated sediments would reduce the risk of pollutant resuspension into the water column, thereby reducing the risk of discharging these materials to Hamilton Harbour or possibly to Lake Ontario.

The removal of contaminated sediments will reduce the sediment oxygen demand in the dredged area. The assimilative capacity of the open water area will be increased. Since the area of the basin that will be filled for sediment disposal is routinely exposed as a mudflat, the overall assimilative capacity of the Basin should not decrease.

This alternative involves the development of an on site solution to the problem which will eliminate the need for large volume trucking of materials. This will reduce the level of nuisance for individuals in the general vicinity of the truck

e) Socio-Political Considerations

The 'Partial Dredging and Fill' option complements the expressed desire to clean up the Windermere Basin. The reduction of Basin area to create an on-site sediment disposal area is seen as the only practical way to avoid the problem of finding an acceptable off-site disposal area. This alternative does not create a situation that will generate the response "Not In My Back Yard" which could stop the project for a prolonged period of time.

3.2.4 Raise Water Level

Raising the water level by constructing a dam at the outlet from Windermere Basin would temporarily resolve the problem of having mudflats exposed to view during periods of low water. However, sedimentation would continue and eventually the sediment levels would accumulate to a point at which the mudflats were again exposed.

This solution would not address the problem of the contaminated sediments in the basin. The uptake of contaminants from the sediments would continue and the risk of sediment scour would remain. The sediments would continue to pose a potential hazard to waterfowl and aquatic life.

a) Environmental Concerns

Calculations indicate that under some runoff and storm conditions, flow through Windermere Basin could reach velocities that would promote the scouring of bottom sediment from the basin. The construction of a dam to raise water levels in the basin would do little to alleviate this problem. In fact, raised water levels could increase the risk of upstream flooding under storm conditions.

The resuspension of contaminants to the water column, as indicated by the 1983 Ontario Ministry of Environment water quality data, would continue.

If Windermere Basin is to remain a waterbody, it will eventually be necessary to remove sediment deposits from the Basin. By postponing a clean-up through raising water levels, it is possible that the future rehabilitation of the basin could be made more difficult.

b) Environmental Benefits

In the short term, the hydraulics of flow through Windermere Basin would be improved slightly at low flows. This should result in some additional assimilative capacity in the basin.

The raising of water levels in Windermere Basin would contribute little benefit to the Basin. The problem of contaminated sediment being in contact with the overlaying water would remain.

c) Aesthetic Considerations

The raising of water levels could eliminate the exposure of mudflats due to the periodic fluctuations in water levels. There would be improvement in the appearance of the Basin, however, the problem of exposed mudflats would recur as sediments continue to accumulate and in time the aesthetic improvement would be lost.

d) Costs

The construction of a permanent dam to control water levels in the Basin would require a thorough engineering study to determine the pertinent design parameters. A relatively simple dyke structure could maintain water at a given level, however, it would be necessary to develop a dam with some form of control structure to permit passing flood flows to minimize the upstream flood risk. The type of structure selected would affect the cost.

Envirosearch estimated prices (1985) for a weir structure across the outlet from the Windermere Basin based upon unit prices used by Mar-land in preparing their 1984 prefeasibility proposal. It was assumed that a dyke structure could be used with a spillway included to pass high flows. The cost was estimated at \$435,000.

e) Socio-Political Considerations

The raising of water levels would improve the appearance of the basin and hence may receive public support, however, the fact that contaminated sediment would still be exposed to the water column and continue to be a threat to waterfowl, is cause for concern.

3.2.5 Create Marsh on Mudflats

The creation of a marsh on the mudflats would involve the selective planting of aquatic plants in the mudflats such that the plants would eventually spread and cover the sediment area that is regularly exposed during low water periods.

This solution could be undertaken with a view to stabilizing the mudflat deposits and reducing the risk of sediments in the mudflats from being scoured from the basin. No flow or water level control structure would be included in this scheme.

a) Environmental Concerns

This alternative involves no sediment removal. As a result, the chance of sediment scour under high flows such as a Regional Storm would still exist but at a somewhat reduced level in that the root mat associated with the plants would tend to stabilize the sediment and reduce its susceptibility to scouring. The hazard to wildlife could increase in that the aquatic plants might attract increased numbers of waterfowl. Once an aquatic plant regime is established there would still be a risk that aquatic life and waterfowl would be exposed to high levels of contaminants that could prove to be toxic to some species. This could result from continued exposure to the sediments in the basin or it could occur as a result of contaminate uptake in aquatic plants under some conditions of fluctuating water levels.

One risk with this option is that the aquatic plants might not take root and survive. Work that has been undertaken by the U.S. Army Corps of Engineers has demonstrated that aquatic plants can be a viable approach to stabilizing sediments, however, the period of time required to create a dense enough root mat to protect the sediments could be several years. There could also be a considerable period of experimental planting required to find the right species that would tolerate the contaminants in the sediment, survive in the fluctuating water levels and be environmentally acceptable.

During high water periods of the year, the plants would be submerged whereas at times of low water levels the plant and root mat would be exposed. It has been demonstrated that under circumstances in which the root is not continually submerged, some aquatic plants will uptake and release metals and pollutants to the environment. This could result in an ongoing release of toxic materials, possibly at a greater rate than if no plant life were present. This could present an additional hazard for wildlife.

The absence of plants on the mudflat at present indicates possible problems in culturing aquatic plants in the basin without making significant physical changes to the basin. If plants were to be established, it is not possible to predict if ongoing sedimentation in the basin would eventually suffocate the plants, or whether the plants would spread onto the newly deposited sediments.

There is insufficient information available to be able to come to a supportable conclusion as to the extent of the environmental risks associated with this alternative. The major concern is the likelihood of sediment scouring during storm events and affecting and contaminating portions of the harbour.

b) Environmental Benefits

The long term benefit to Windermere Basin from establishing aquatic plants in the mudflats would relate to the stabilization of the sediments and the elimination of the view of barren mudflats during periods of low water. A portion of the existing assimilative capacity of the basin would be maintained.

c) Aesthetic Considerations

With the creation of a marsh environment in the areas of the Basin in which mudflats are regularly exposed the presence of the aquatic plants could be seen to enhance the aesthetics of the area.

d) Costs

The establishment of a marsh environment in the mudflat areas would involve labour intensive work that would have to be undertaken in stages. Initially, there would have to be experimental plantings followed at a later date by a full scale planting program. The cost of this type of work would be relatively low in comparison to other structural or dredge dependent options.

An initial estimate of the studies that should be undertaken to confirm the probable success of a marsh stabilization project for the mudflats plus an estimate for the cost of labour to undertake the project indicates that the total cost could be in the order of \$500,000.

e) Socio-Political Considerations

The creation of a marsh environment on the mudflat areas of the basin is a sacrificial type of action in which the surface area of the Basin would be reduced. With the general opposition to filling the basin, it is questionable whether this alternative would be welcomed in that the type of marsh that would be created would essentially be the final stages in an environmental conversion from an aquatic to a terrestrial environment.

3.2.6 Create an Engineered Tertiary Treatment Marsh

The creation of an engineered tertiary treatment marsh would involve removing the contaminated sediments from the basin and using these sediments as shore area fill. Water level control berms, flow distribution channels and sediment traps could also be created to provide an environment in which aquatic plants could be cultured to create a marsh. The marsh could become a tertiary treatment facility for the Woodward Avenue Sewage Treatment Plant. A sediment trap area within the basin could reduce the volume of sediments passing through the Basin into Hamilton Harbour. The shore disposal area would have to be designed for the containment of highly contaminated sediments or alternatively the sediments may have to be stabilized prior to being placed in the containment area.

The creation of an engineered marsh to serve as a tertiary treatment facility for the Woodward Avenue Sewage Treatment Plant and to act as a settling basin to trap solids from Redhill Creek would necessitate that the basin be dredged, and a series of berms be constructed to maintain minimum water levels in the marsh area. The berms could direct all dry weather flow through the marsh portion of the Basin, while permitting the bypassing of high flows around the marsh. The settling basins would be designed to remove solids and reduce the rate of solids loading on the downstream areas of the harbour.

A berm could be constructed along the southerly and westerly sides of the Basin to permit fill operations adjacent to the Stelco and National Slag properties. The proposal would involve the removal of contaminated sediment from the Basin and the placing of these materials behind the berm. Berms would be constructed to control flow at the inlet end of the marsh near the Sewage Treatment Plant, and along the north side of the Basin. Water levels in the marsh would be maintained relatively constant.

a) Environmental Concerns

The major concern associated with this alternative is the loss of pollutants to the aquatic environment during the removal of contaminated sediments from the Basin. Losses could also occur during the placement of the sediments in the disposal area.

There is also the concern that wildlife could be exposed to pollutants in the sediment disposal area prior to capping.

b) Environmental Benefits

The hydraulics of flow through Windermere Basin would be improved. This would provide an opportunity to create a sediment trap in the basin that could reduce the need for maintenance dredging further downstream in the approach channel to the Strathearne slip and in the areas adjacent to the East Port pier facilities.

The removal of the contaminated sediments would reduce the risk of pollutant resuspension into the water column, thereby reducing the risk of discharging these materials to Hamilton Harbour or possibly to Lake Ontario.

The assimilative capacity of the Basin would be increased if the sediments having a high sediment oxygen demand were removed and aquatic plants were planted to create a marsh environment. This would provide additional treatment to the effluent from the Woodward Avenue Sewage Treatment Plant prior to its discharge to Hamilton Harbour.

c) Aesthetic Considerations

The removal of the sediments from the Basin could eliminate the exposure of mudflats during periods of low water levels. The aesthetics of the Basin area would be improved through the creation of areas with aquatic plants.

d) Costs

An 'Engineered Tertiary Treatment Marsh' would require the expenditure of a significant sum of money for the contaminated sediment removal portion of the work, plus associated berms and sediment trap dredging as well as establishing aquatic plant cultures.

Envirosearch estimated costs (1985) based upon the Mar-Land Engineering prefeasibility report (1984) dredging and berm

costs and the Trow (1983) estimates for the cost of fixing sediments. The estimated cost for the development of an engineered tertiary treatment marsh was \$6.4 to \$7.15 million.

e) Socio-Political Considerations

The creation of an 'Engineered Tertiary Treatment Marsh' environment would complement the expressed desires to undertake a Windermere Basin clean-up.

3.2.7 Channelize and Fill

Channelizing and filling the basin could ultimately eliminate the problem of exposure of contaminated sediments. However, the work may have to proceed over a prolonged period of time if the cost of obtaining the volume of fill required is to be kept to a minimum. During this period the remaining portion of the basin would become a stagnant pond with even less aesthetic appeal than currently exists.

This option would result in the loss of the Basin and its associated assimilative capacity. As a result, all sediment from Redhill Creek and the Woodward Avenue Sewage Treatment Plant would be carried through to Hamilton Harbour.

If a decision is taken to fill the basin, it would be necessary to retain a channel of sufficient size to pass the streamflow from Redhill Creek plus the flow from the Woodward Avenue Sewage Treatment Plant.

In undertaking the filling of the Basin it would be necessary to construct berms that would delineate the channel through the basin. Some dredging would be required to remove contaminated sediment from the new channel. Filling could then take place without the risk of displacing bottom sediment into Hamilton Harbour.

a) Environmental Concerns

Channelizing and filling Windermere Basin would result in all sediments currently being discharged from Redhill Creek and the Woodward Avenue Sewage Treatment Plant being passed through into Hamilton Harbour. In addition, the oxygen demand loadings from the Sewage Treatment Plant would not be reduced and consequently, an additional oxygen demand loading would be discharged to the Harbour.

The Basin would have to be dyked prior to filling or else the filling process would result in the displacement of contaminated sediment to Hamilton Harbour. If the Basin is dyked to protect the Harbour, a stagnant pond would then be created for the duration of the filling process. This in turn could create hazardous conditions for waterfowl and other aquatic life in the area.

The aesthetics of the basin would be severely degraded throughout the period of the fill activities.

b) Environmental Benefits

Eventually the contaminated sediments in the basin would be covered over with clean fill.

c) Aesthetic Considerations

The elimination of the basin would see future development and an end to any possible waterbody setting. During the short term while the fill work would be in progress, the aesthetics of the area would deteriorate.

d) Costs

If the project were undertaken over a prolonged period of time when there was significant construction activity in the Hamilton area, the fill could be obtained and placed with minimal capital expenditure.

The major cost would be for the construction of the berms and the shaping of the fill material. The costs for filling the Basin was estimated to be \$1,900,000. The cost could be more than offset in that at an estimated market value in the order of \$50,000 to \$65,000 per acre (\$124,000 to \$160,000 per hectare), approximately 20 hectares of reclaimed land should be marketable at \$2.5 to \$3.2 million.

e) Socio-Political Considerations

Filling Windermere Basin would be counter to the current desires of the public to have the harbour area upgraded and 'beautified'.

3.3 RANKING of ALTERNATIVES

Envirosearch (1985) concluded that the water quality data indicated some quality degradation within Windermere Basin and the associated sediment data indicated gross contamination of the sediments throughout the Basin. An accompanying analysis of flow velocities through the Basin indicated that velocities in excess of levels known to cause scouring could be expected each year. The analysis also indicated that there was a significant risk of scouring of contaminated sediments from Windermere Basin should a major storm event occur.

The Envirosearch report concluded that there was justification for taking action to isolate the contaminated sediments in Windermere Basin from the environment.

The alternatives that were discussed in the 1985 Envirosearch report are summarized in Table 2. These alternatives were not all found to fulfill the objective of isolating the contaminated sediments.

The 'Do Nothing', 'Create Marsh' and 'Raise Water Level' options would continue to permit intimate contact between the contaminated sediments and the water flowing through the Basin and aquatic life in the Basin. Creating a marsh or raising the water level could provide some aesthetic improvements in the Basin, but the existing risk of water quality degradation would remain as would the potential hazard to aquatic life.

Channelizing and filling the Basin could resolve the problem of having the sediments exposed to the overlying water, but the solution would destroy what was to originally be preserved (i.e. Windermere Basin).

The complete dredging of the Basin with the sediments being either incinerated or trucked to a landfill could accomplish the original goal, however, the \$22.9 to \$35.1 million price tag for the clean-up was considered to be very expensive.

Envirosearch (1985) identified a series of options that were considered to warrant further investigation as possible solutions for the isolation of the contaminated sediments in the Windermere Basin. The options identified were:

- 1 - Partial Dredge and Fill;
- 2 - Dredge, Stabilize and Fill;
- 3 - Dredge, Stabilize and Create a Tertiary Treatment Marsh.

It was concluded that if the original objective of preserving the Basin was foregone, then a fourth option could include the 'Channelize and Fill' alternative.

These findings were reported to the Windermere Basin Technical Advisory Committee for their consideration.

TABLE 2
WINDERMERE BASIN STUDY - SEDIMENT DISPOSAL ALTERNATIVES

OPTIONS	DO NOTHING	DREDGE AND LANDFILL	DREDGE AND INCINERATE
ENVIRONMENTAL CONCERNS	-scour sediment in regional storm. -contaminated area for waterfowl & aquatic life. -assimilative capacity decreasing from sedimentation. -increasing sediment transport to harbour. -eventually cleanup would still be required.	-loss of contaminants during dredging. -complete dredging will need offsite disposal. -existing suitable disposal sites costly. -to license new site will be opposed by neighbours.	-loss of contaminants during dredging. -incinerate sediment at Woodward Avenue Sewage Treatment Plant
ENVIRONMENTAL BENEFIT	-none	-improved hydraulics. -improved assimilative capacity. -eliminates exposed contaminants. -offsite disposal ensures no leaching.	-improved hydraulics. -improved assimilative capacity. -eliminates exposed contaminants. -incineration of sediment ensures no leaching.
SOCIO-POLITICAL CONSIDERATIONS	-poor image -has been an expressed interest in cleanup of basin. -contravenes 'BEAUTIFY HARBOUR' concept.	-expect 'NIMBY' response in vicinity of disposal area. -double problem of contaminated sediment for disposal & excess truck traffic to disposal site.	-violation of phosphorus criteria for Woodward Avenue Sewage Treatment Plant.
AESTHETICS	-unsatisfactory.	-improved.	-improved.
COSTING	-nil	\$22.9 to \$35.1 million	\$19.1 million

TABLE 2 (CONT'D -1)
WINDERMERE BASIN STUDY - SEDIMENT DISPOSAL ALTERNATIVES

OPTIONS	PARTIAL DREDGE & FILL	DREDGE-STABILIZE-FILL	RAISE WATER LEVEL
ENVIRONMENTAL CONCERNS	-loss of contaminants during dredging. -use portion of basin as a disposal area. -will have to secure disposal area against loss of contaminants in sediment. -reduced surface area will lower assimilative capacity potential.	-loss of contaminants during dredging. -use portion of basin for disposal area. -stabilizat'n increases volume to be disposed. -reduced surface area will lower assimilative capacity.	-contaminated sediments remain. -sediments still likely to scour in regional storm. -contaminated area for waterfowl & aquatic life. -likely to increase upstream flooding potential. -eventually cleanup would still be required.
ENVIRONMENTAL BENEFIT	-improved hydraulics. -eliminates exposed contaminants. -reduced hazard to wildlife.	-improved hydraulics. -eliminates exposed contaminants. -reduced risk of contaminated leachate.	-buys time. -cosmetic.
SOCIO- POLITICAL CONSIDERATIONS	-is reduced surface area acceptable?	-is reduced surface area acceptable?	-will public accept a short term cosmetic improvement.
AESTHETICS	-some improvement.	-some improvement.	-short term cosmetic improvement.
COSTING	\$3.96 to \$4.0 million	\$6.0 to \$6.79 million	\$435,000

TABLE 2 (CONT'D -2)
WINDERMERE BASIN STUDY - SEDIMENT DISPOSAL ALTERNATIVES

OPTIONS	CREATE MARSH	TERTIARY TREAT'T MARSH	CHANNELIZE & FILL
ENVIRONMENTAL CONCERNS	-attract wildlife to contaminated sediments. -current conditions don't support aquatic plant growth. -reduced open water could lead to loss of dissolved oxygen in basin.	-loss of contaminants during dredging. -use portion of basin for disposal area. -will have to secure disposal area against loss of contaminants in sediment or stabilize sediment.	-reduction in surface would reduce assimilat'n potential. -all sediment would be discharged to harbour. -if berm to reduce loss of contaminants during filling will have a large stagnant pond. -loss of aquatic environment.
ENVIRONMENTAL BENEFIT	-aquatic plants hide sludge banks. -aquatic plants might stabilize sludge.	-improved hydraulics. -eliminates exposed contaminants. -additional treatment for STP effluent. -additional aquatic habitat.	-would eventually isolate contaminants from aquatic environment.
SOCIO-POLITICAL CONSIDERATIONS	-is marsh accepted as beneficial area or as 'more weeds'.	-not fill but is treatment marsh desired alternative.	-should the waterbody be eliminated. -is additional land required.
AESTHETICS	-may or may not be seen as an improvement.	-may or may not be seen as an improvement.	-is filled land area an aesthetic improvement?
COSTING	\$500,000	\$6.4 to \$7.15 million	\$1.9 million

4.0 SELECTION OF AN ALTERNATIVE

The Windermere Basin Technical Advisory Committee reviewed the alternatives listed in Table 2 that had been identified by Envirosearch. The Committee reported:

"Although the chemical stabilization (fixation) of dredgate is not a proven science, enough research data is available to conclude that fixation will make it more difficult for toxic substances to escape into the environment. There are, however, a number of problems with the fixation technique, not the least one being its cost. (Estimated cost of dredging and regular disposal - \$4,400,000; dredging and disposal with stabilization of dredgate - \$7,700,000). In addition, there is the problem of increased volume. The fixation process involves the addition of considerable quantities of fly ash lime (or other suitable additives) to the dredgate which would more than double its final volume. This added volume would obviously aggravate the disposal problem."

In view of the the fact that the results from the original Ontario Ministry of Environment tests to determine whether the sediments were 'hazardous' were found to be in error, the Committee sought clarification by requesting new testing of basin sediments. The Wastewater Technology Centre was requested to undertake additional testing including the Ontario testing procedures to determine whether the sediments were 'hazardous'. The tests (WTC 1986) confirmed the sediments were 'non-hazardous' and that stabilization prior to disposal was not required to ensure that sediment contaminants did not migrate from the disposal site.

In the light of the Wastewater Technology Centre study, the Committee concluded that "fixation would not be necessary". Having rejected the need for stabilization and rejected the alternatives involving off-site sediment disposal and the channelizing and filling of the Windermere Basin, the committee was left with the alternative of partial dredging with the disposal of contaminated sediments in confined disposal areas within the Windermere Basin.

4.1 SELECTED ALTERNATIVE

The Windermere Basin Technical Advisory Committee recommended:

1. That the basin be partially dredged
2. That the sediments be disposed of on site behind

containment berms.

3. That the sediments be disposed of without chemical stabilization."

The Committee also addressed a series of questions related to the clean-up of Windermere Basin. The questions addressed and the Committee response follow.

How much sediment should be removed?

Committee recommendation:

"To make the project effective, it is important that seriously contaminated sediments be removed from contact with open water. Generally, this will involve the top 70 centimeters, although the actual depth will vary from location to location. Taking the above criterion in mind, it is estimated that a minimum of 280,000 cubic meters of sediment is to be removed from open water contact. There will be no requirement to remove contaminated sediment from the designated disposal areas."

Which area of the basin should be set aside as a sediment disposal area?

Committee recommendation:

"Several locations with different configurations are feasible. A final selection will, to a large extent, depend on design considerations, the ultimate use to be made of the containment area, and the ownership of the basin."

How much water volume and surface area should be maintained?

Committee recommendation:

"It is important to maintain as large a water volume and water surface area as possible. Volume is required to make the basin functional as a sediment settling area. A substantial water surface area is important as it increases the basin's capacity to absorb oxygen from the atmosphere. Considering the quantity of fill to be disposed of it should be possible to maintain at least 50% of the basin's surface area."

What precautionary measures should be taken during the sediment removal process?

Committee recommendation:

"Measures must be taken during the dredging process to minimize the transportation of contaminated sediment from the basin to the harbour and possibly Lake Ontario. The area to be dredged must therefore be isolated during the dredging operation. There are a range of possibilities, e.g.

- A system of weirs
- Bubble curtains
- Silt curtains
- Bypass channels.

The final design is to determine the best system to use."

What should be the ultimate land use of the dredgate disposal area once the dredging is completed?

Committee recommendation:

"This question is considered to be beyond the mandate of the committee and was therefore not dealt with. Decisions on land use matters must be made through normal Regional and City planning procedures."

How can the project be of benefit to improve the aesthetics of the basin?

Committee recommendation:

"The dredging of the basin offers an excellent opportunity to improve the aesthetics of the area. The degree of this improvement will, to a large extent, depend on the location and configuration of the disposal areas as well as their ultimate use. Although members expressed certain points of view on this question, it was considered to be beyond the committee's mandate to make recommendations and/or suggestions."

Which agency should be the project proponent?

Committee recommendation:

"The Hamilton Harbour Commissioners have offered to be the project proponent. Both Regional and City Councils have accepted this offer. It is the opinion of the committee that the Hamilton Harbour Commissioners would be a suitable proponent, subject to all requirements respecting environmental and land use issues being met

wherever they apply."

Will it be necessary to undertake an environmental assessment before the project is started?

Committee recommendation:

"Since the Hamilton Harbour Commissioners will be the likely project proponents, it is expected that a Federal environmental project appraisal will be required. The work done by the Windermere Basin Technical Committee and the technical reports produced will greatly assist in streamlining the process."

What preventative measures should be undertaken to prevent a similar situation from recurring?

Committee recommendation:

"It is essential that a long term commitment on maintenance and preventative measures be made. Preventative measures would include the following:

- An urban stormwater management program for Redhill Creek (Cities of Hamilton and Stoney Creek, Township of Glanbrook)
- The control of combined sewer overflows
- Upstream erosion control measures (Conservation Authority, Region, City, landowners)
- The setting of high water quality standards for all effluent discharging into the basin (MOE)

In spite of these long range preventative measures, it is expected that some sediments will continue to settle in the basin. The final design of the basin should be such to allow for the trapping of the sediments in special settling areas. These settling areas will require periodic dredging."

The committee went on to conclude that:

"the rehabilitation of the Windermere Basin is one of the highest environmental and aesthetic issues in the Region. After much research and debate, there now appears to be a viable solution".

4.1.1 Most Viable Alternative

The recommendation of the Windermere Basin Technical Advisory Committee to undertake the partial dredging of the basin with

the creation of a sediment disposal facility within portions of the Windermere Basin is supported by the findings of previous investigators.

A total of nine alternatives were investigated in the Envirosearch report that was prepared for the Windermere Basin Technical Advisory Committee. While all options were considered to be technically possible, the viability of these alternatives varied.

The 'do nothing', 'raise water level' and 'create marsh on the mudflats' alternatives never addressed the critical question of isolating the contaminated sediments from the overlying water column. This led the committee to dismiss these alternatives as not being acceptable.

The Envirosearch alternatives that included the stabilization of the sediment prior to being placed in disposal facilities within the basin would pose a significant problem. The volume of the stabilized sediment would be approximately double the volume of the material dredged from the basin (Trow 1983). It would be difficult to maintain as much of the basin volume and surface area as possible if the sediment were stabilized. In addition, the cost would nearly double if sediment stabilization were undertaken. The above, coupled with the Wastewater Technology Centre findings (1986) that contaminants could be suitably confined in dyked sediment disposal areas, making stabilization unnecessary, confirmed the viability of a conventional confined disposal area. With these facts, the Windermere Basin Technical Advisory Committee concluded that the on-site disposal alternative using conventional confined disposal was acceptable and the use of sediment stabilization was unnecessary.

The complete dredging alternatives were discounted for a number of reasons. The logistics problem in trucking sediment including the risks posed by large scale transport of the contaminated materials on the road system, the cost to haul the dewatered sediment to off-site disposal areas plus the tippage fees to landfill the sediment would make these alternatives both impractical and very expensive. An even more crucial factor was the absence of any suitable off-site disposal facility nearby. As a consequence, it would be necessary to create a new disposal facility. The likelihood of receiving approval for such a facility was considered to be extremely remote.

The alternative to incinerate the sediment at the nearby Woodward Avenue Sewage Treatment Plant was costly plus, it would have also meant putting the plant in serious violation of the Canada-Ontario Great Lakes Water Quality Agreement. The several years that would have been required to undertake this

alternative further reduced the desirability of the alternative.

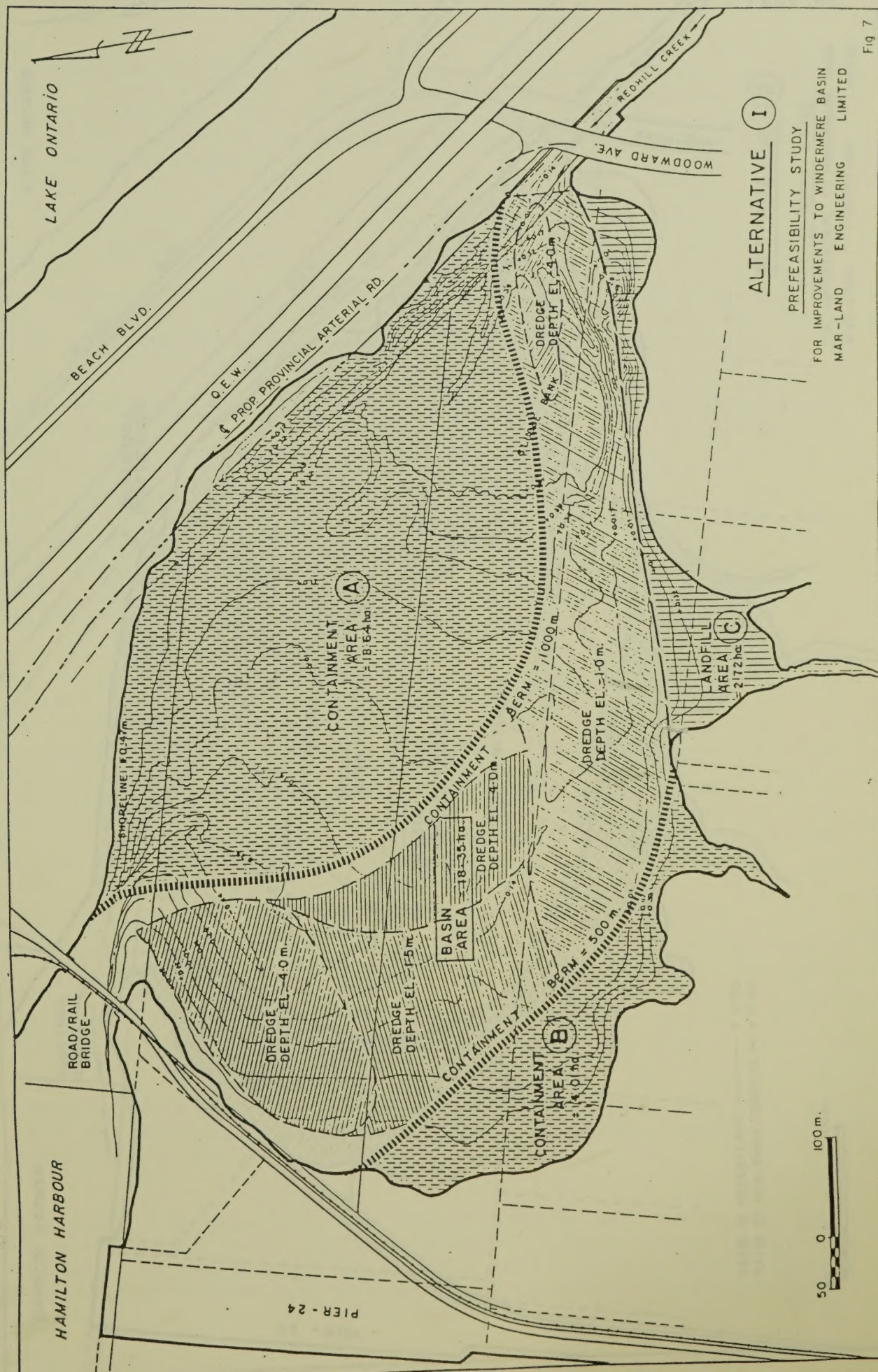
In summary, it was concluded that the partial dredge and fill option was one of the most environmentally safe alternatives. The amount of sediment dredging could be minimized through the judicious selection of the sediment disposal area. The work areas could be isolated through a staged construction program that would permit bypassing the sewage treatment plant effluent and Redhill Creek streamflow during the clean-up. This would minimize the loss of contaminants from the sediment. Once confined, the sediments could be isolated from the adjacent waterbody. This combination of minimal environmental impact plus a least cost clean-up were factors favouring the partial dredge and fill option.

4.1.2 Partial Dredge/Fill Configuration

The partial dredge and fill option was first identified by Mar-land Engineering Limited in 1984 in their Prefeasibility Study - Proposed Improvements To Windermere Basin. The 1984 report identified two alternatives (I and II). These alternative configurations are presented in Figures 7 and 8.

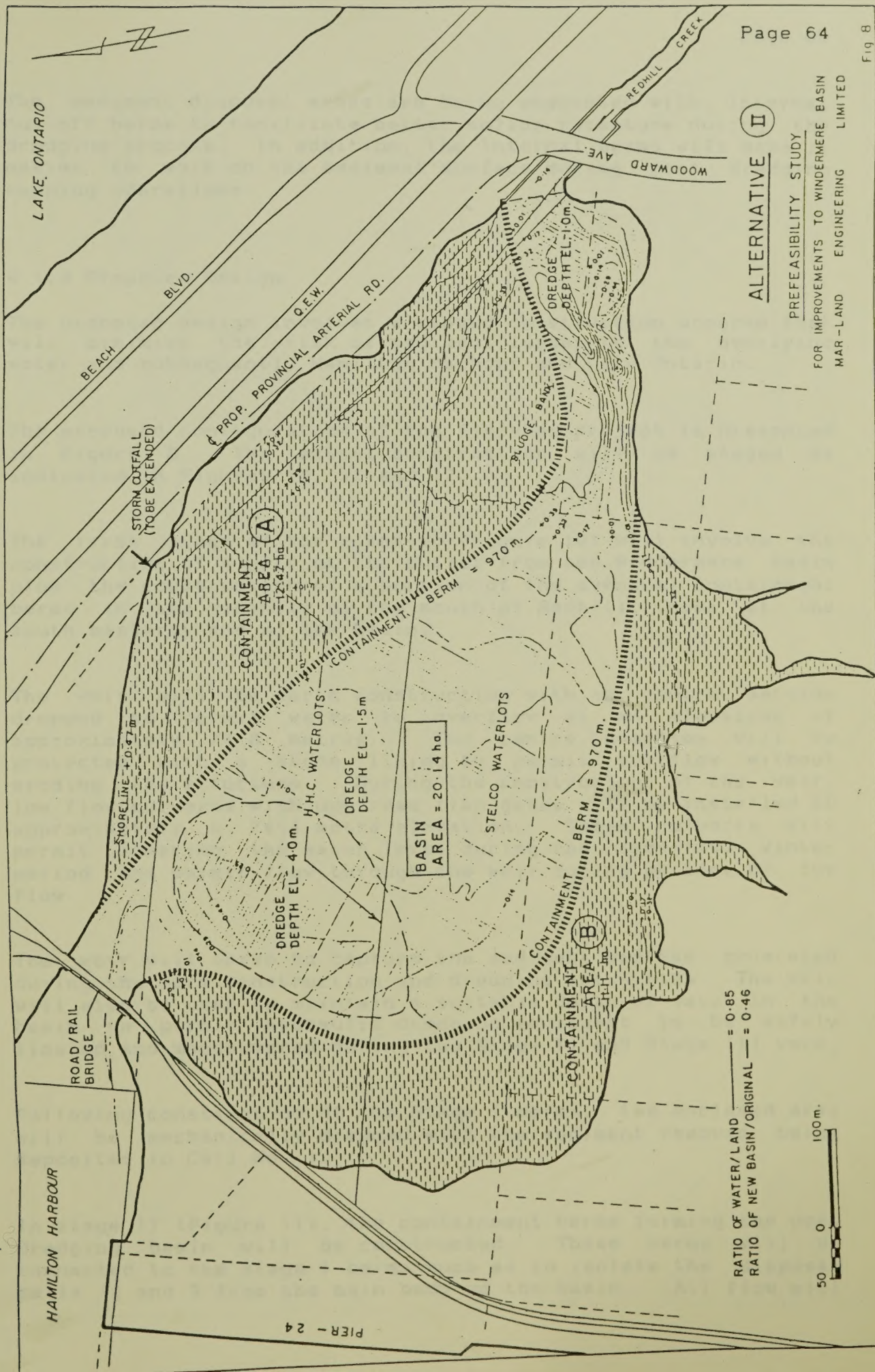
The Alternative I configuration would minimize the amount of contaminated sediment removal in that the disposal area would encompass the majority of the existing sludge bank. Unfortunately, the surface area of the water remaining in Windermere Basin would only be in the order of 18.4 hectares or 41% of the before clean-up basin area. The Alternative II concept involved changing the location of the containment berms such that the north-east sediment disposal area was reduced from approximately 18.6 to 12.5 hectares in size. The south and west shore disposal areas would increase from approximately 6.7 to 11.1 hectares. These changes would permit the retention of a relatively centrally located water area of 20.1 hectares (46% of the before clean-up basin). The net volume of the basin will increase from 28% to 128% depending on the water level.

The project is similar to the Alternative II proposal described in the 1984 Mar-land report. The current concept includes some changes to the berm configuration to minimize problems associated with passing peak flows through the basin. An hydraulic model has been constructed to determine the best layout for sediment trap areas and to verify and fine tune armouring requirements for the portions of the north inlet berm that will be most severely impacted by the peak flow discharges from the Redhill Creek.



II
ALTERNATIVE

PREFEASIBILITY STUDY
FOR IMPROVEMENTS TO WINDERMERE BASIN
MAR-LAND ENGINEERING LIMITED



The sediment disposal areas are being segmented with internal cut-off berms to facilitate better solids recapture during the dredging process. In addition, the internal berms will make it easier to work on the sediment surface during post dredging capping operations.

4.1.3 Proposed Design

The proposed design involves a staged construction program that will minimize the risk of sediment losses to the overlying water and subsequently Hamilton Harbour and Lake Ontario.

The proposed configuration of the finished project is presented in Figure 9. The actual construction will be staged as indicated in Figures 10, 11 and 12.

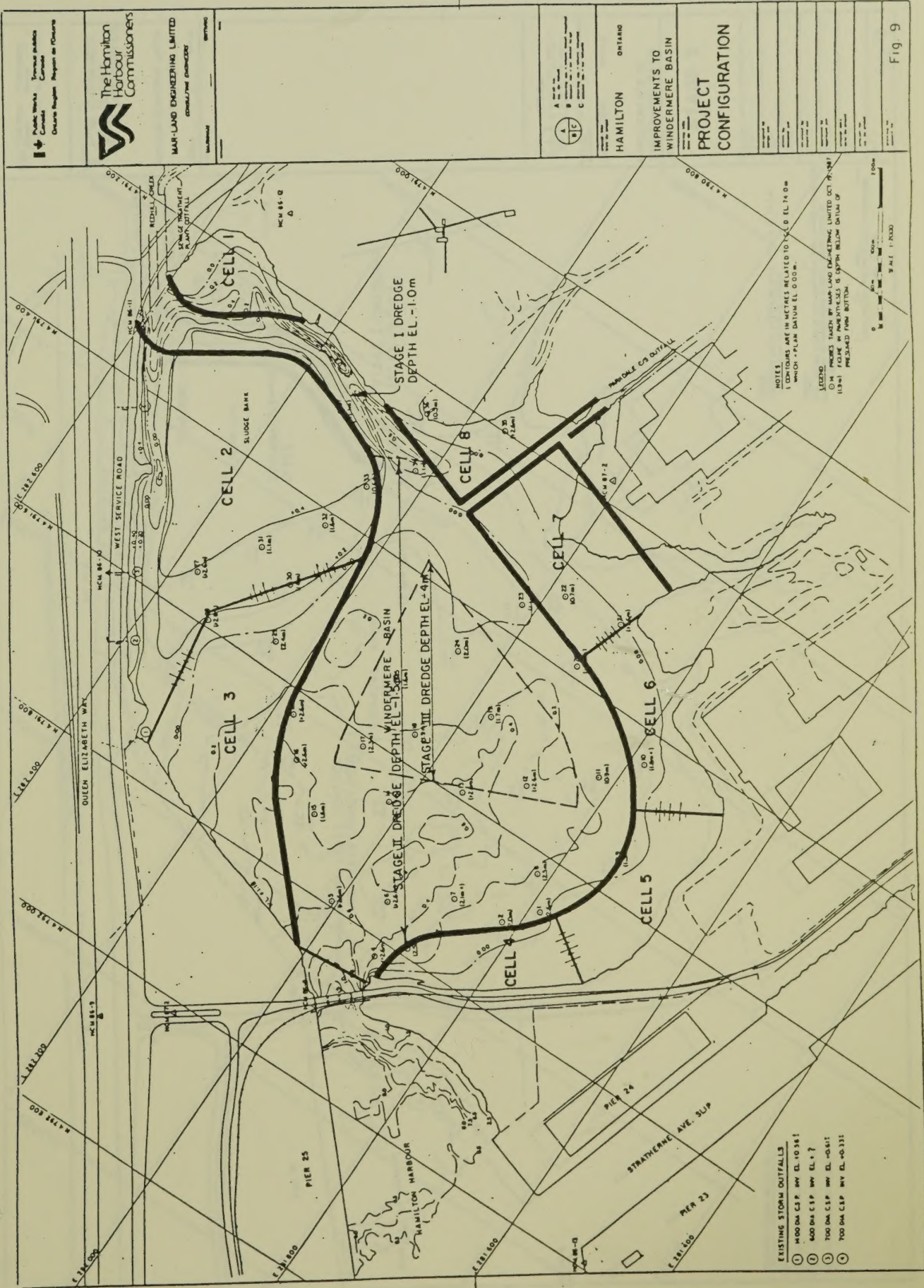
The first stage of the clean-up (Figure 10) will involve the construction of a weir at the outlet from the Windermere Basin plus the construction of a portion of the eventual containment berms in the vicinity of the mouth of Redhill Creek at the south easterly end of the basin.

The weir will be earth construction with a centre section dropped to permit water to overflow at an elevation of approximately 74.8 metres. The centre overflow will be protected with a stone lining to permit overflow without eroding the structure. During the construction of the weir, low flow culverts with upstream flap gates will be installed at approximately a 74.4 metre elevation. These culverts will permit lowering the water level during the 1989-1990 winter period and permit flow through the weir during periods of low flow.

The weir will serve to capture the sediment bedload generated during the berm construction and dredging activities. The weir will also be used to maintain a suitable depth of water in the basin to permit hydraulic dredging equipment to be safely floated and manoeuvred during the Stage II and Stage III work.

Following construction of the Stage I berms, the enclosed area will be mechanically dredged with the sediment removed being deposited in Cell No. 1.

In stage II (Figure 11), the containment berms forming the post dredging basin will be constructed. These berms will be connected to the stage I berms such as to isolate the disposal cells 2 and 3 from the main body of the basin. All flow will



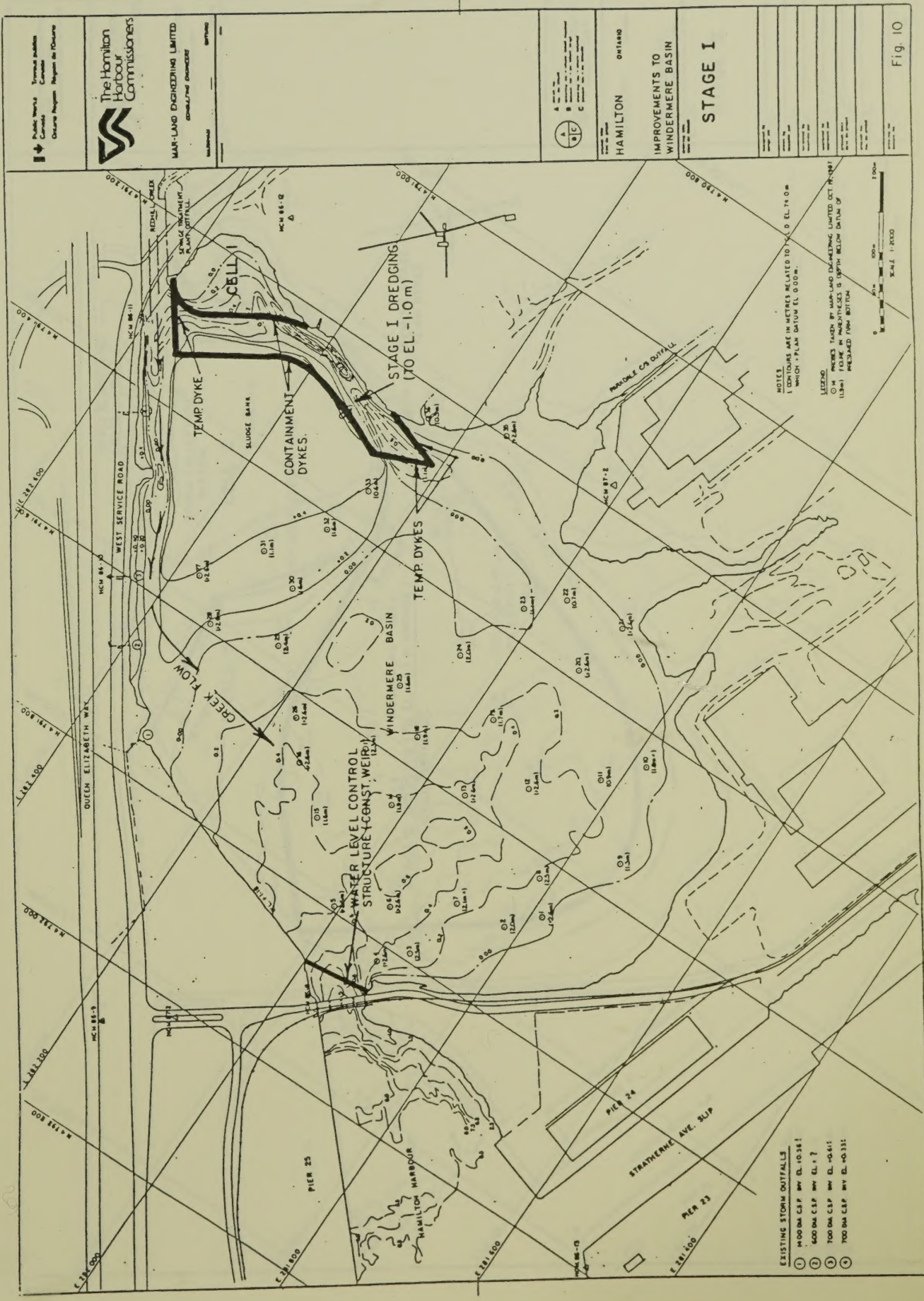
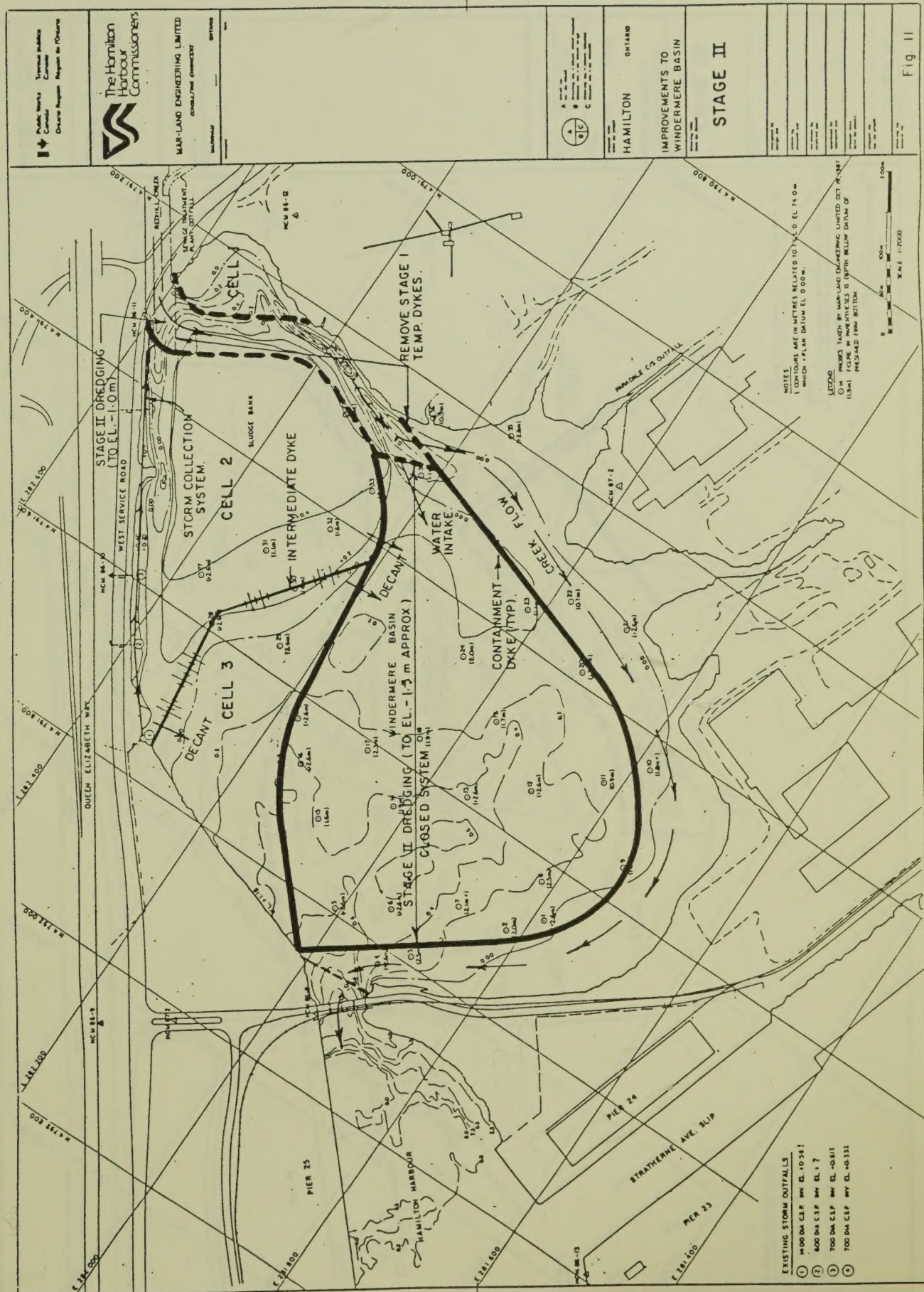
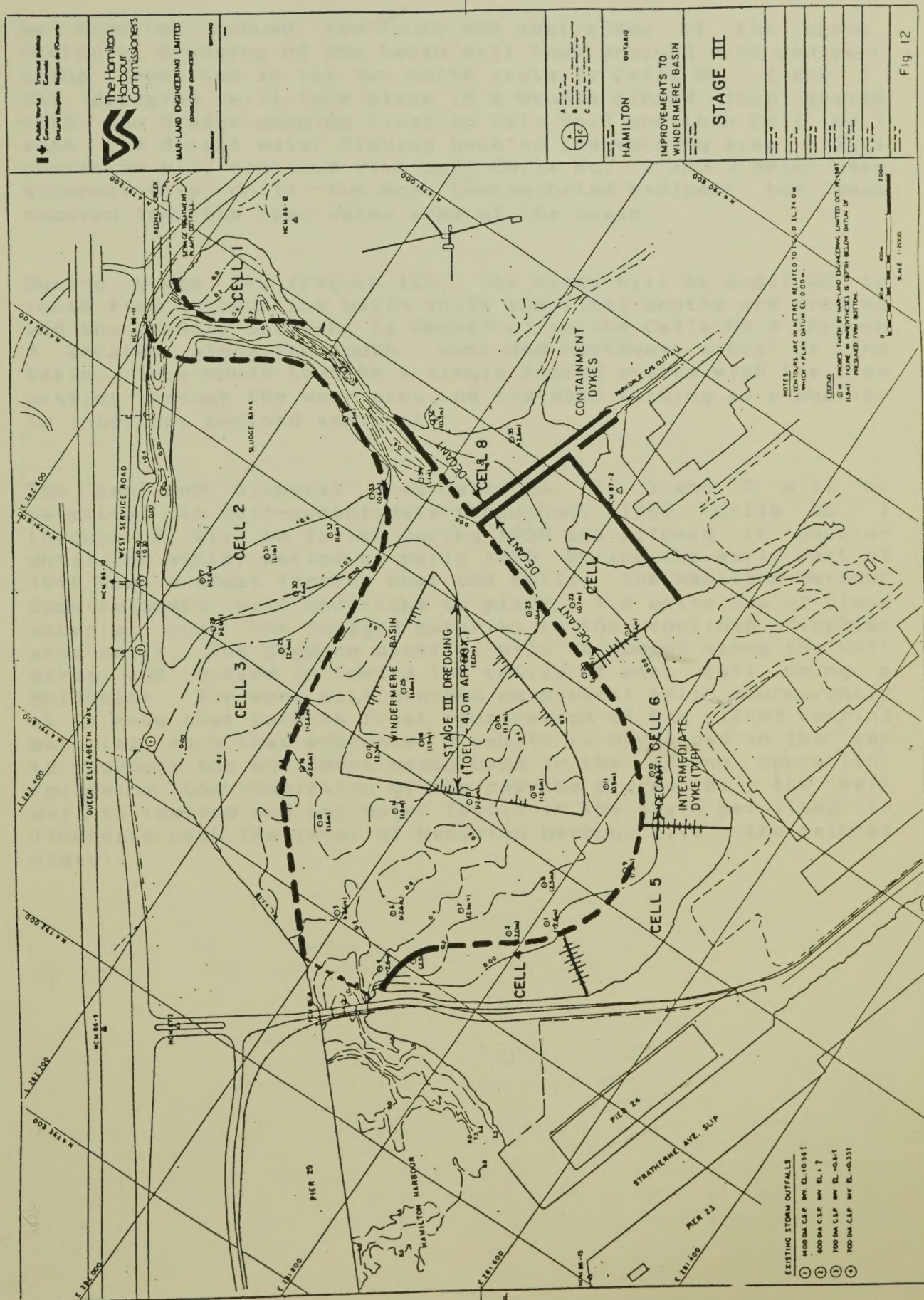


Fig. 10





be diverted around the south and west sides of the basin. Hydraulic dredging of the basin will then proceed with sediment being deposited in the two north easterly Cells No. 2 and 3. The dredging will take place in a double closed loop system with the dredge pumping first to Cell No.2 and then Cell No.3 with the decant water flowing back to the working area. This operation will continue with both Cells No. 2 and 3 being used alternatively until the most contaminated sediment has been removed from the open water area of the basin.

During stage III (Figure 12), the berms will be modified to route flow through the basin while the final depths are dredged and the dredged sediment is deposited in the Cells No.4 through 8 located along the south, west and northwest sides of the basin. This would then be a single closed system with the flow passing through the work area and the weir serving as a barrier to intercept bedload sediment

The confined disposal area Cells No. 1, 2 and 3 will be permitted to self-consolidate throughout 1989. Cells No. 4 through 8 will be filled during 1989 and allowed to dewater until the winter period of early 1990. During the early part of 1990 when a crust freezes over the cells, the Hamilton Harbour Commissioners will undertake to place a 1.0 metre cap of clean material over the dredged material in the confined disposal area cells. The capping material will be dumped along the cell berms and worked in toward the centre of each cell using a bulldozer. The work will proceed on several cells concurrently at a rate that permits frost penetration of the placed capping material such that adequate strength is developed in the cap to support the equipment being used in the capping operation. Following the completion of the capping procedures, the weir will be removed and the water levels in the basin permitted to fluctuate with the level of Hamilton Harbour (i.e. the natural state).

5.0 DESCRIPTION OF THE PROJECT ENVIRONMENT

The environment related to the project is the area around the southeast portion of Hamilton Harbour.

This section of the harbour, Windermere Basin, has gradually become degraded over the years through the deposition of contaminated sediments. Testing has shown that in general, the top 20 to 30 centimetres of sediments contain the most serious contamination with lesser degrees of contamination occurring in the sediments lying in the range of 30 to 60 centimetres in depth. Sediments in some areas of the basin, specifically the mudflat that is exposed during low water levels, could contain contaminants to greater depths.

The analysis of the sediments indicates that they are of light density with a high organic content. The nature of the sediments makes them susceptible to being resuspended into the water column under high flow conditions. The Wastewater Technology Centre has shown (WTC 1986) that the sediments are such that they can be safely isolated in a confined disposal area with minimum risk of the contaminants being leached from the disposal area back into the adjacent waters. The sediments have been tested using Ontario Ministry of Environment procedures and have been found to be 'non-hazardous' as defined by Ontario Regulation 309.

The absence of aquatic plants in the majority of the shallow areas and mortalities in the populations of waterfowl that have overwintered in the basin provides evidence that it may not be possible to establish a healthy population of flora and fauna in Windermere Basin under existing conditions.

The accumulation of contaminated sediments has caused considerable damage to the Windermere Basin ecology. Studies by MOE 1982, Envirosearch 1985 and Persaud 1987 have documented sediment related environmental degradation.

If the contaminated sediments could be retained within Windermere Basin, the damage to the surrounding ecology would be limited. However, sediment testing in the Strathearne Avenue Approach Channel has indicated that contaminated sediment appears to be migrating from Windermere Basin. Theoretical calculations, Envirosearch (1985), indicate that there is an ongoing loss of sediment from the basin during periods of high flows. This sediment that is being lost is capable of affecting the water, sediments and biota in downstream sections of Hamilton Harbour.

5.1 THE PHYSICAL ENVIRONMENT

Windermere Basin is surrounded by industrial development on the south and west, the Hamilton Harbour Commissioners' East Port facilities on the north, the Queen Elizabeth Highway and the East Port arterial road on the east and the Hamilton water and sewage treatment plants and the Woodward Avenue and Burlington Street arterial roads on the southeast.

The Windermere Basin receives the streamflow from Redhill Creek, effluent from the Woodward Avenue Sewage Treatment Plant, combined sewage overflows from the Parkdale Avenue combined sewer and storm drainage from portions of the East Port facilities, the Queen Elizabeth Highway and the East Port Drive. The Redhill Creek has been the recipient of combined sewage bypasses for several years. In 1987, Hamilton-Wentworth completed the construction of the Greenhill stormwater holding facility to intercept approximately 95% of the combined sewage bypasses previously discharged to the Redhill Creek at Greenhill Avenue. Recent changes in the operations at the Woodward Avenue Sewage Treatment Plant have facilitated a considerable reduction in the combined sewage overflow discharges from the sewage collection system and the raw sewage by-passes at the sewage treatment plant that were previously discharging to the Windermere Basin. The average flow through the Windermere Basin includes 60,500 cubic metres per day from Redhill Creek and 340,000 cubic metres per day (75 MGD) of effluent from the Woodward Avenue Sewage Treatment Plant. The Ontario Ministry of Environment estimated (1982) that combined sewage bypassing to Windermere Basin averaged 4,000 cubic metres per day.

Effluent from the Woodward Avenue Sewage Treatment Plant makes up 85% of the inflow water to Windermere Basin. The combination of a relatively high rate of flow plus the elevated temperature that is traditionally associated with sewage treatment plant effluent results in the Windermere Basin remaining virtually ice-free throughout the winter.

The actual basin is clogged with accumulations of sediment and debris that detracts from its appearance for prolonged periods each year when water levels are low. This accumulation of sediment and debris is blatantly obvious from the adjacent arterial roads and the Queen Elizabeth Highway. The present condition of Windermere Basin is such that it offers little aesthetic appeal. The resultant poor impression derived from the Windermere Basin does not complement the efforts being put forward by the City and Regional governments and local authorities and organizations to beautify and enhance the Hamilton environment.

Ontario is currently engaged in a program to enlarge the Queen Elizabeth Highway and the Region of Hamilton-Wentworth has plans for the construction of a major arterial access highway linking the Queen Elizabeth Highway with the southern sections of Hamilton. The Queen Elizabeth Highway is currently the principal road link to the Niagara Peninsula and the State of New York via Lewiston, Niagara Falls and Fort Erie. With highway upgrading, the anticipated vehicular traffic on the Queen Elizabeth Highway adjacent to Windermere Basin should continue to increase. Subsequently the Windermere Basin, due to its location, will continue to be seen by larger numbers of visiting tourists, businessmen and commercial travellers each year. Under the existing conditions that can be observed in the Windermere Basin the visitor can not be expected to be favourably impressed.

5.2 PHYSICAL, BIOLOGICAL AND CHEMICAL CHARACTERISTICS

Windermere Basin has been created through landfilling in the south-easterly end of Hamilton Harbour. This landfill has eliminated the natural marshland that previously surrounded this area of the harbour. Water depths in the basin have been reduced through sedimentation to the current levels which range from zero to approximately one metre. The sediments are predominantly fine grained inorganic and organic particles. An area of 20 hectares (one half of the area of the basin) is filled with sediments to above the normal low water level (MOE 1982). The sediments are composed of layers of soft black material overlying brown silty sand.

The contaminants in the basin have contributed to degrading the chemical quality of both the sediments and the overlying water in Windermere Basin. Generally, the chemical analyses of Windermere Basin sediments indicate high levels of heavy metals, organics (loss on ignition and total organic carbon), greases and oils and chlorinated hydrocarbons including PCB's. Envirosearch (1985) studied water quality data from the Windermere Basin and found that quality of the overlying water column changed as the water flowed through the basin. The quality of water was found to initially deteriorate as it flowed into the basin and came into contact with the highly contaminated sediments. Near the exit from the basin, water quality improved to a level generally of better quality than existed on entry to the basin. Under storm conditions and high flows, the exit quality was poorer than the incoming quality.

5.3 QUANTITY AND QUALITY OF SEDIMENTS TO BE REMOVED

The 1982 Windermere Basin Study indicated that the most contaminated sediments were confined to the upper 70 centimetres of the basin and made up a volume of approximately 280,000 cubic metres (measured over the entire basin).

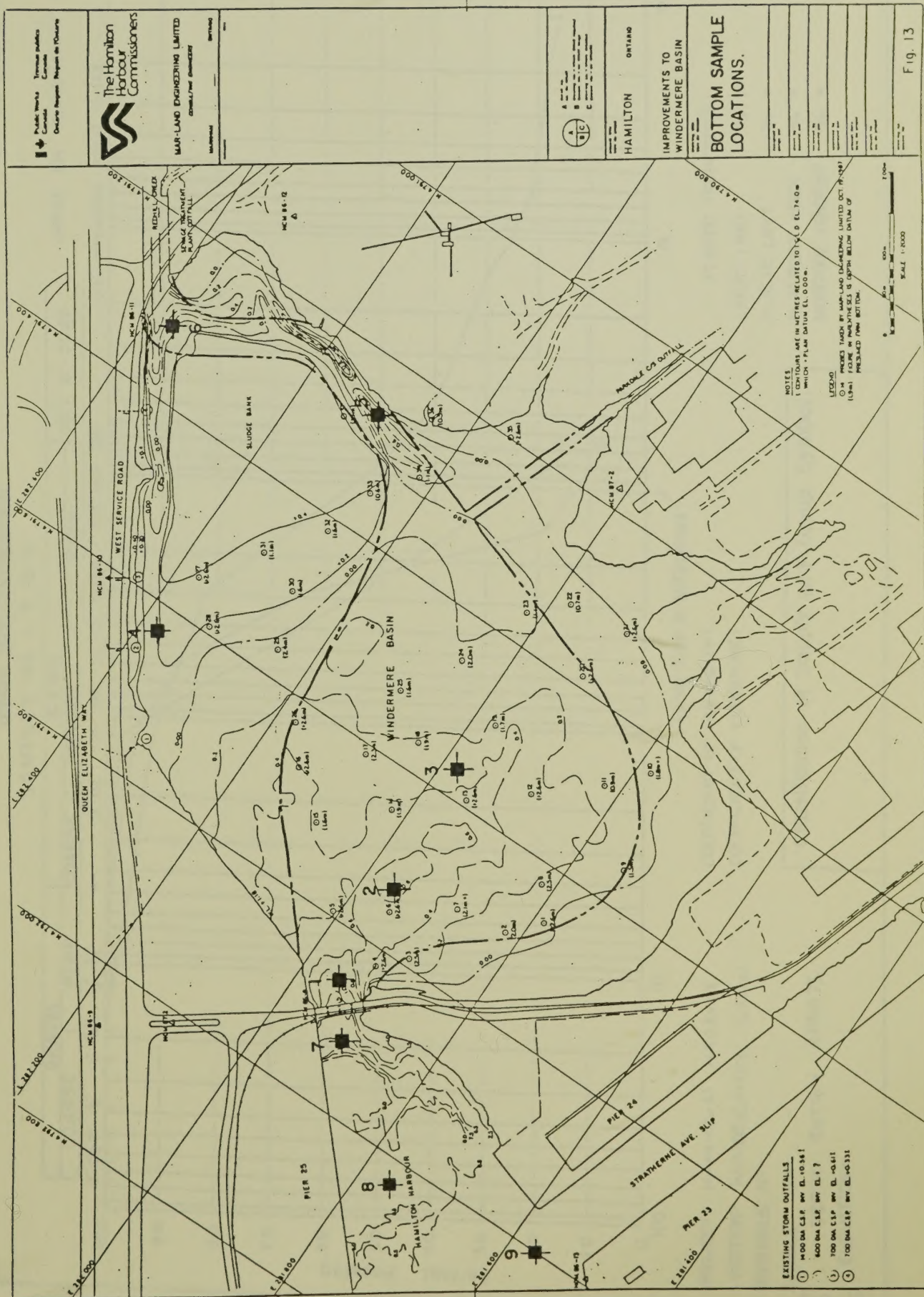
The recommended 'partial dredge and fill' alternative attempts to minimize the required dredging by locating a confined sediment disposal area to coincide with the major sludge deposits in the southeast portion of the basin. The remainder of the contaminated sediments located within the proposed open water area are to be removed along with underlying deposits to an average depth of 1.0 metres in the inlet channel and 1.5 metres in the remaining open water areas. A portion of this open water area is to be deepened to 4.0 metres to provide additional sediment trap capacity that will extend the useful life of the basin as a sediment retention area following a clean-up. Depths are quoted depths below the 74.0 metre chart datum level.

By locating the containment areas where the worst sludge accumulations have occurred, the volume of contaminated sediment that must be removed is reduced. The 240,000 cubic metres of contaminated sediment to be removed in this project includes the sediment and underlying material to the 1.0 metre depth in the inlet channel and 1.5 metre depth in the open water area. The additional materials to be excavated for the proposed sediment trap (to a depth of 4.0 metres) total 113,000 cubic metres. The total sediment volume to be dredged is 353,000 cubic metres. The depths quoted are depths below the 74.0 metre chart datum.

Sediment samples were collected in Windermere Basin and analysed for grain size distribution by V.A. Wood Associates Limited as part of the preliminary engineering design work for the project. The samples were collected from seven locations as indicated in Figure 13. The grain size distributions are shown in Figures 14 and 15.

At the inlet channel to the basin (Fig. 13 - location #6), the sediments were found to consist predominantly of fine sands with lesser portions of medium sands, silts and a small percentage of coarse sands. Within the basin, at the discharge end of the proposed inlet channel (Fig. 13 - location #5), the sediments consisted predominantly of fine sands plus silt and clay materials with a small percentage of medium sands.

In the open water portion of the basin (Fig. 13 - locations #2,



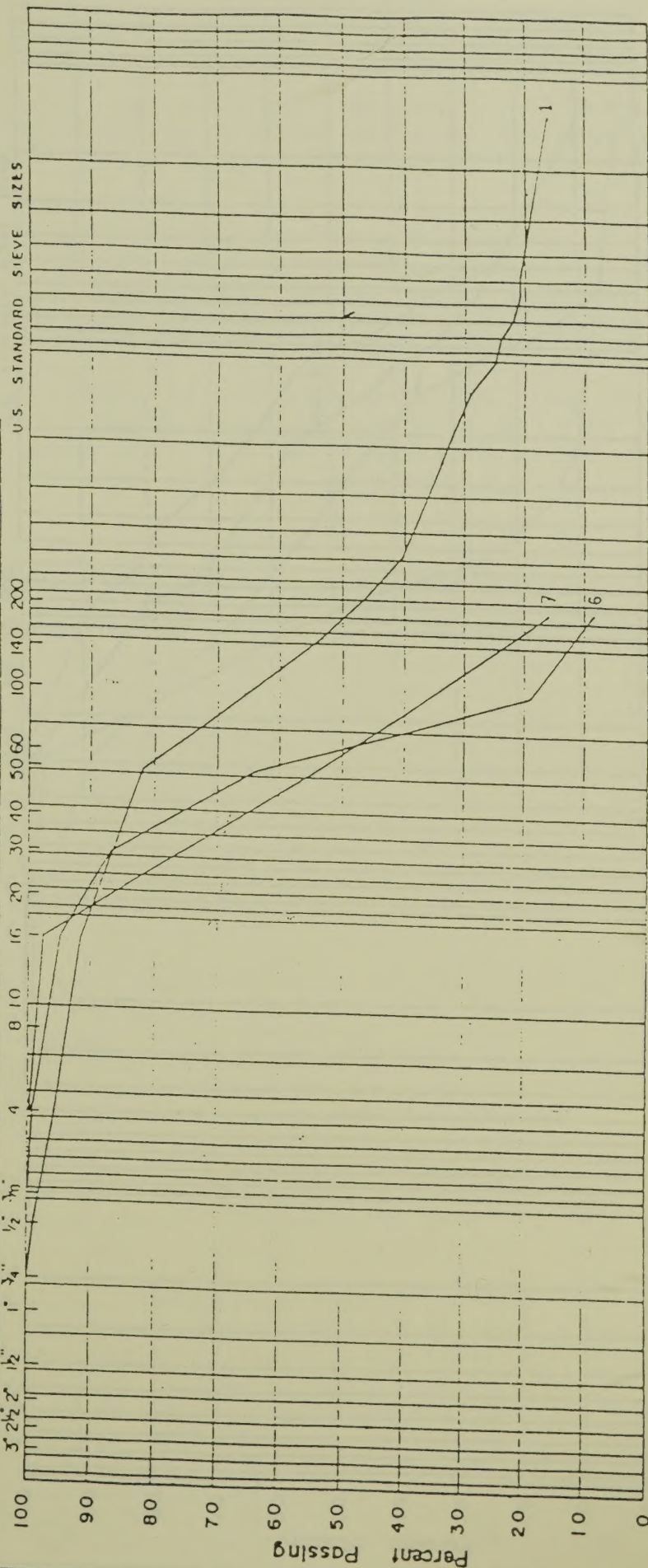
V.A. WOOD ASSOCIATES LIMITED

OUR REFERENCE NO 1316-8-1

GRAIN SIZE DISTRIBUTION
SAMPLES NO 1, 7, & 6

UNIFIED SOIL CLASSIFICATION SYSTEM

GRAVEL		SAND		SILT & CLAY	
COARSE	FINE	COARSE	MEDIUM	FINE	



0.001

0.01

0.1

1

10

100

1000

10000

100000

1000000

10000000

100000000

1000000000

10000000000

PLASTIC PROPERTIES

LIQUID LIMIT %
PLASTIC LIMIT %
PLASTICITY INDEX %
MOISTURE CONTENT %

COEFFICIENT OF UNIFORMITY

COEFFICIENT OF CURVATURE

Classification of Sample and Group Symbol:

PROJECT: HAMILTON HARBOR

LOCATION: WINDERMERE BASIN

BOREHOLE NO:

SAMPLE NO:

DEPTH: BOTTOM DEPTH

ELEVATION:

V.A. WOOD ASSOCIATES LIMITED

OUR REFERENCE NO 1316-8-1

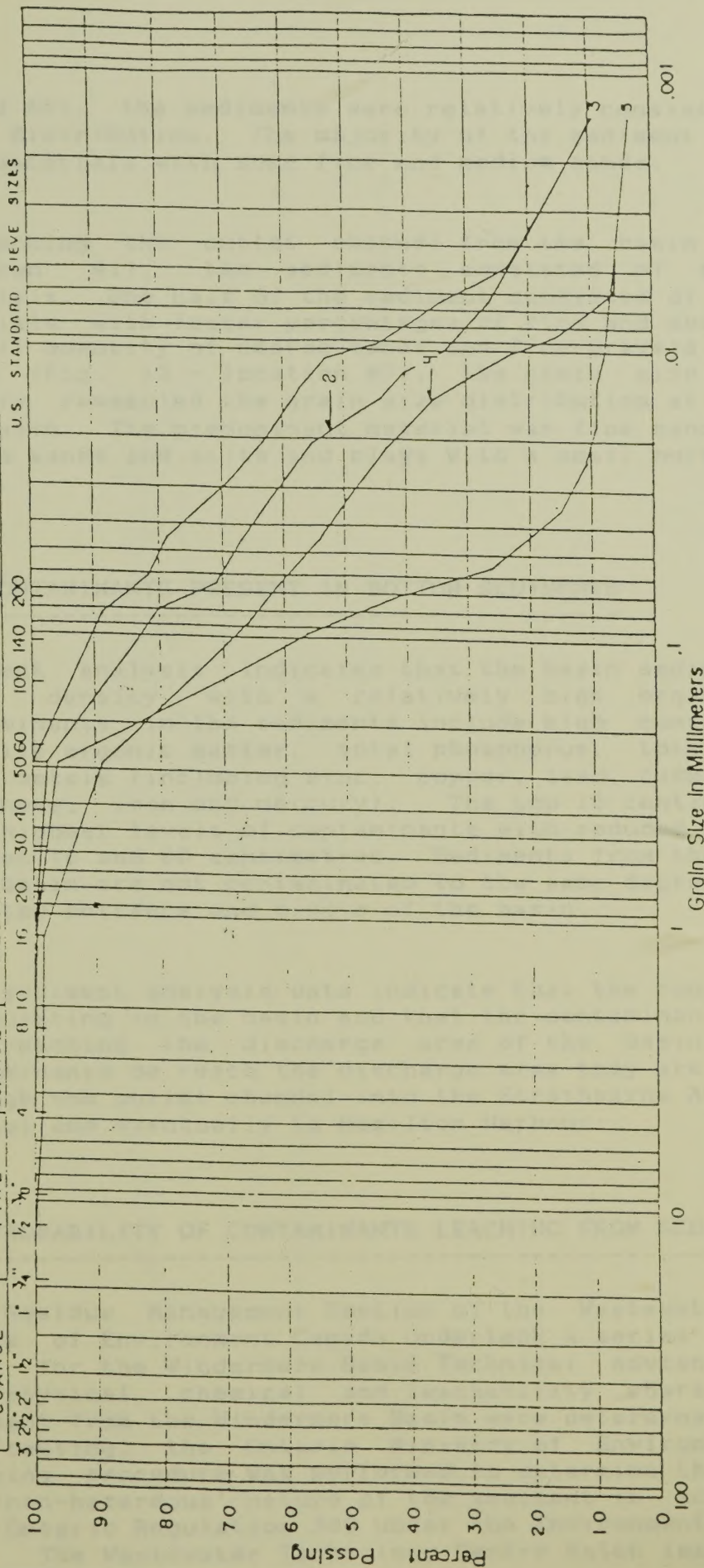
GRAIN SIZE DISTRIBUTION
SAMPLES NO 2, 3, 4, & 5

UNIFIED SOIL CLASSIFICATION SYSTEM

SILT & CLAY

SAND
COARSE MEDIUM FINE

GRAVEL
COARSE FINE



PROJECT: HAMILTON HARBOUR
LOCATION: WINDERMERE BASIN
BOREHOLE NO:
SAMPLE NO:
DEPTH: BOTTOM DEPOSITS
ELEVATION:

Classification of Sample and Group Symbol:

#3 and #4), the sediments were relatively consistent in grain size distribution. The majority of the sediment was silt and clay materials with some fine and medium sands.

Approaching the outlet channel from the basin (Fig. 13 - location #1), the sediments consisted of some coarser materials. One half of the sediment consisted of silt and clay materials with lesser percentages of fine and medium sands and a small quantity of coarse sands and fine gravels. Outside the basin (Fig. 13 - location #7), the grain size distribution closely resembled the grain size distribution at the inlet to the basin. The predominant material was fine sands followed by medium sands and silts and clays with a small portion of coarse sands.

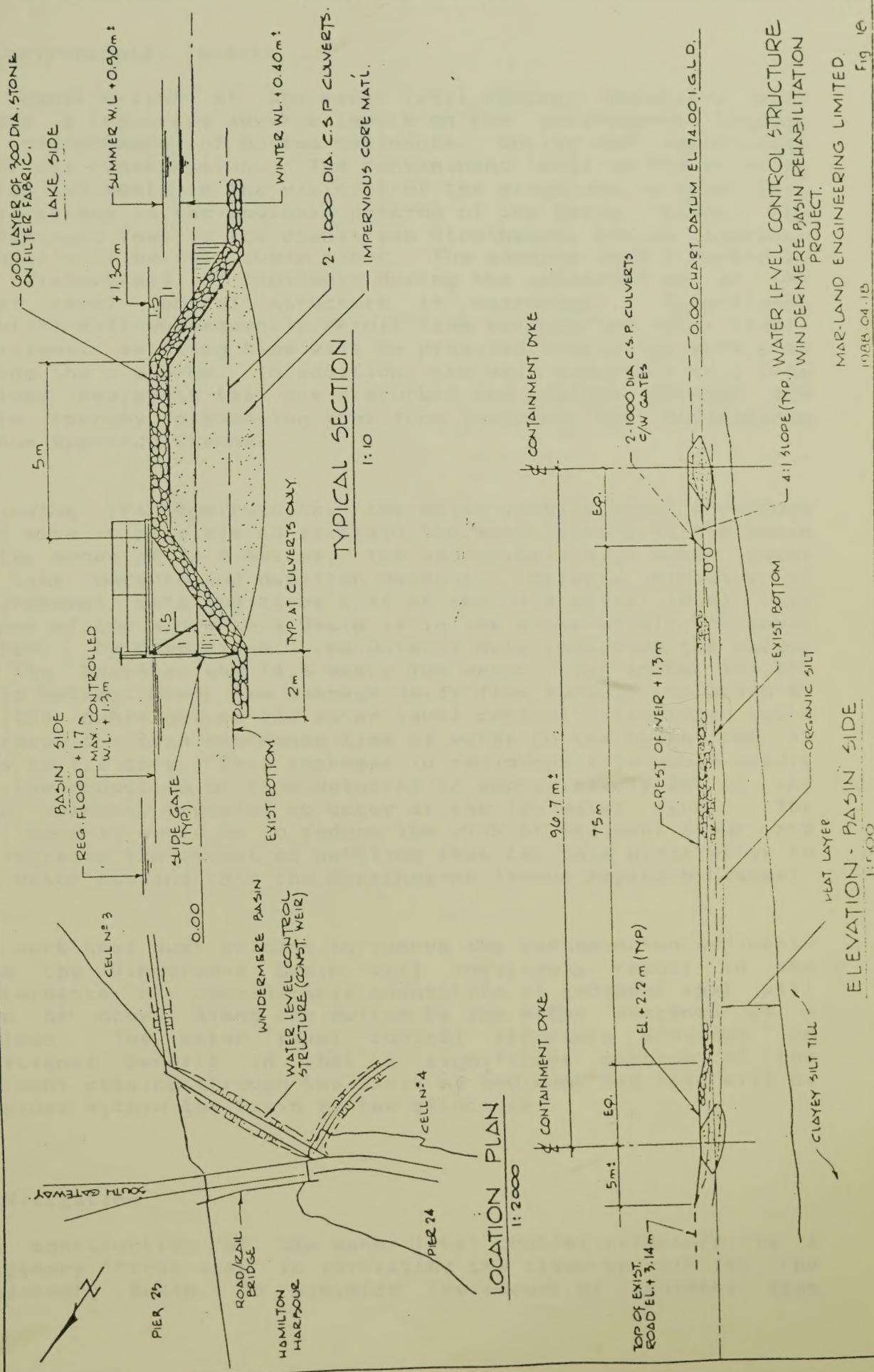
5.4 CONTAMINANTS PRESENT IN BOTTOM SEDIMENTS

Sediment analysis indicates that the basin sediments are of light density with a relatively high organic content. Contaminants in the sediments include high concentrations of volatile organic matter, total phosphorus, total nitrogen and heavy metals (including zinc, copper, lead, cadmium, chromium, manganese, iron and mercury). The top 16 centimetres contain the highest levels of contaminants with reduced concentrations between 16 and 60 centimetres. Sediments from the exit end of the basin are not contaminated to the same degree as sediments near the entrance and middle of the basin.

The sediment analysis data indicate that the contaminants are accumulating in the basin and that the contaminants are either not reaching the discharge area of the basin, or if the contaminants do reach the discharge area they are being carried through the outlet channel into the Strathearne Avenue Approach Channel and eventually to Hamilton Harbour.

5.5 PROBABILITY OF CONTAMINANTS LEACHING FROM SEDIMENTS

The Residue Management Section of the Wastewater Technology Centre of Environment Canada undertook a series of tests (WTC 1986) for the Windermere Basin Technical Advisory Committee. The physical, chemical and leachability characteristics of sediment from the Windermere Basin were determined. As part of the testing, the Ontario Ministry of Environment standard leaching procedure was performed to determine the 'hazardous' or 'non-hazardous' nature of the sediment in accordance with the Ontario Regulation 309 under the Environmental Protection Act. The Wastewater Technology Centre batch leaching test was



a) Environmental Impacts

The construction of the water level control structure will create a temporary adverse impact on the environment through the disturbance of bottom sediments, during and immediately after its construction. The contaminant level in the existing bottom sediments in the vicinity of the structure is lower than at locations in the southern portion of the basin, hence, the contaminant loss to the downstream Strathearne Avenue Approach Channel will be relatively minor. The adverse impact caused by the disturbance of sediments during the construction of the water level control structure is warranted. Significant benefits will subsequently result from raising the water level. Additional settling time will be provided within the work area during the clean-up. In addition, the weir structure will trap bedload sediments that are disturbed and migrate through the basin thereby preventing them from reaching the Strathearne Avenue Approach Channel.

Following its construction, the water level control structure will make it possible to maintain the water levels in the basin in the order of 74.9 metres, the approximate high water level in Lake Ontario and Hamilton Harbour. Ontario Ministry of Environment data indicates that at the 74.9 metre level, the volume of the Windermere Basin is in the order of 510,000 cubic metres. By comparison, the Ontario data indicates the volume of the basin at the 74.4 metre low water level to be 184,000 cubic metres. Given the average daily flow through the basin of 405,000 cubic metres the water level control structure could increase the mean residence time of water in the basin from .45 days to 1.3 days. This increase in residence time would result in the reduction of flow velocity to approximately 36% of the mean velocity expected to occur at the low water level. The net benefit would be to reduce the risk of sediment scour and to increase the amount of settling that can take place prior to the water passing into the Strathearne Avenue Approach Channel.

The work that must be done to remove the contaminated sediments from the Windermere Basin will inevitably result in the disturbance of considerable quantities of sediment that will then be moved along the bottom by the water currents as a bedload. The water level control structure provides an additional benefit in that a significant portion of the sediment passing through the basin as sediment bed load will be retained within the basin by the structure.

b) Mitigation

The construction of the water level control structure is a necessary 'first step' in initiating the clean-up work for the Windermere Basin. To minimize the amount of sediment loss

arising from the construction of the structure, the construction work should ideally take place during periods of low flow. Fill should not be dumped during storms or other events accompanied by high rates of streamflow. By restricting berm construction to periods with low flow conditions the flowthrough velocity in the basin will be at a minimum and there will not be as great a problem with sediment resuspension as would occur during periods when higher flows exist.

6.2.2 Confined Disposal Area - Cells No. 1 and 2

Berm Construction

During the stage 1 work, the berms that will define the new inlet channel to the basin will be constructed (see Fig.10). This channel will eventually carry the streamflow from Redhill Creek and the effluent from the Woodward Avenue Sewage Treatment Plant west to the south of the large sludge bank that is located in the south end of the basin. During this stage of construction all berms will be constructed by end dumping.

A temporary berm will be constructed from the shore at the west side of Redhill Creek to divert flow toward the north along the northeast shore of the Windermere Basin. The berms that will define the inlet channel to the basin will be constructed with a temporary berm being constructed across the outlet end of the channel.

a) Environmental Impacts

The diversion of the total flow along the northeast shore of the Windermere Basin is likely to cause the resuspension of some of the sediment located in this area. This will have a temporary adverse impact on water quality.

The construction of the berms defining the inlet channel will result in the displacement of a quantity of highly contaminated sediment with the resuspension of a portion of this sediment. Most of the resuspended sediment is likely to settle in the open areas of the basin or be trapped by the construction weir.

b) Mitigation

If the water level control structure is completed and the water level in the basin is raised to the 74.9 metre level prior to the commencement of construction of the diversion berm that will force the Redhill Creek flow and the Woodward Avenue Sewage Treatment Plant effluent along the north shore of the

6.3 STAGE 2

The stage 2 portion of the project involves the construction of a containment berm around the future south and westerly perimeter of the basin that will be used to form a channel to divert all flows to the water level control structure. The berm will be the outer containment berm for Cells No. 4 through 8.

Containment berms will be constructed for disposal Cells No. 2 and 3 which will be used to confine the most heavily contaminated sediments from the clean-up dredging of the open portion of the basin. During this period of dredging, the water flow will be diverted through the south and westerly bypass channel.

6.3.1 Confined Disposal Cells 2 to 8 Berm Construction

A containment berm will be constructed that will define the post clean-up south and westerly perimeter of the basin (see Fig. 11). This berm will be used in the stage 3 portion of the work to construct the confined disposal cells No. 4 through 8. For the stage 2 portion of the work, a temporary berm will connect the east shore of the basin at a point south of the water level control structure to the north end of the containment berm along the south and westerly sides of the basin. A second temporary berm will connect the easterly end of the southerly containment berm to the west end of the northerly inlet channel berm, constructed as part of the stage 1 work. The temporary berms at each end of the inlet channel will be removed, and a permanent berm will be constructed at the east end of the northerly inlet channel berm to divert all flow from Redhill Creek and the Woodward Avenue Sewage Treatment Plant through the inlet channel and around the temporary south and westerly channel. Drainage from the Parkdale Avenue combined sewer overflow will discharge to the temporary south and westerly channel. Drainage from the East Port Drive and the Queen Elizabeth Highway will be directed along the northeast shore of the disposal cells No. 2 and 3 to discharge to the inlet channel at the Woodward Avenue Bridge.

The containment berm and the interior berm for disposal Cells No. 2 and 3 (see Fig. 11) will be constructed.

The disposal cells No. 2 and 3 will receive the most heavily contaminated sediments from the clean-up dredging of the open portion of the basin.

a) Environmental Impact

The construction of the containment berm that will form the south and westerly by-pass channel is likely to cause resuspension of some of the sediment located in the path of the berm. This will have a temporary adverse impact on water quality. During the initial flow diversion period, it is expected that there could be scouring of light surface sediment that has accumulated along the south shore of the basin, particularly around the Parkdale outfall.

The construction of the containment berm and the intermediate berm for the disposal cells No. 2 and 3 will require the displacing of considerable quantities of contaminated sediment. This is likely to cause the release of contaminants into the water column.

b) Mitigation

The stage 2 work should continue with water levels near the 74.9 metre level to maintain water currents at a low velocity.

By sequencing the work it will be possible to take advantage of the current regime and minimize the rate of loss of sediment. The stage 1 flow diversion along the northeast shore of the basin should be maintained and the south and westerly containment berm constructed moving from east to west to north commencing at the west end of the northerly inlet channel berm. This work should proceed until the berm is near the west approach of the East Port Bridge. The temporary end berms for the inlet channel should then be removed. Until this point, the sediments disturbed by the berm construction will be isolated from the main water flow which has been diverted across the northern portion of the basin. Once the temporary end berms are removed, flow will start to follow the south and westerly channel. The completion of the east end of the inlet berm should then be undertaken which will divert all flow through the south and westerly channel. At this point, the north end of the south and westerly berm should be closed off by working west from the east shore of the basin. This sequence will divert the flow out of the basin and into the south and westerly bypass channel with minimum uptake of contaminants due to sediment resuspension.

With the basin isolated from the flow, the containment and interior berms for the disposal cells 2 and 3 can then be constructed with no impact on downstream water quality. However, the disturbance of the sediments during this phase of the berm construction could begin to bring about a dissolved oxygen deficiency in the basin. If this occurs, odour problems

could begin to develop. If odour problems become severe, remedial measures may be required including the possibility of temporarily halting work.

6.3.2 Stage 2 Clean-up Dredging

The streamflow from Redhill Creek and effluent from the Woodward Avenue Sewage Treatment Plant will be bypassed through the south and westerly channel while the clean-up dredging of the Windermere Basin is undertaken. This approach will permit the use of hydraulic equipment with a minimum rate of sediment loss. The dredged sediments will be placed in disposal cells No. 2 and 3. The decant water from disposal cells No. 2 and 3 will be circulated back into the dredge area. This approach will effectively make the clean-up of the central portion of the basin a double closed loop operation.

The contaminated sediments will be removed to 1.5 metres below datum (72.5 metres). This will result in a basin depth following removal of the construction weir of 1.9 to 2.4 metres at low and high water respectively.

a) Environmental Impact

The hydraulic dredging operation will undertake to move contaminated sediments that have poor settling characteristics. As a consequence, the water within the closed basin area will become very heavily contaminated with suspended sediment. This will deplete the dissolved oxygen levels within the basin. There is no evidence of great numbers of fish in Windermere Basin, however, any carp or other fish that might be present and become trapped in the work area will most likely be killed. In all probability, odour problems will arise.

The contaminants in the sediments could become a hazard to waterfowl when they are suspended in the water column and prior to capping when they are exposed in the confined disposal areas. The current situation also poses a hazard for waterfowl.

b) Mitigation

If the odours produced during the dredging operation reach nuisance levels, it could become necessary to provide supplementary aeration using diffused air or mechanical surface aeration equipment or temporarily suspend dredging operations. Criteria will have to be established to determine when remedial

measures for odour control are required.

If the construction activities do not frighten waterfowl away, discussions may be required with the Canadian Wildlife Service to determine a suitable approach to discourage the presence of waterfowl in the basin and the confined disposal areas during the course the clean-up operations.

6.4 STAGE 3

The stage 3 portion of the project involves the removal of the temporary berms that diverted flow around the south and westerly perimeter of the basin and the completion of the placing of containment berms to create disposal cells No. 4 through 8. The water flow is to be directed back through the basin with discharge to Hamilton Harbour over the water level control structure weir. The Parkdale Avenue combined sewer outfall will be extended.

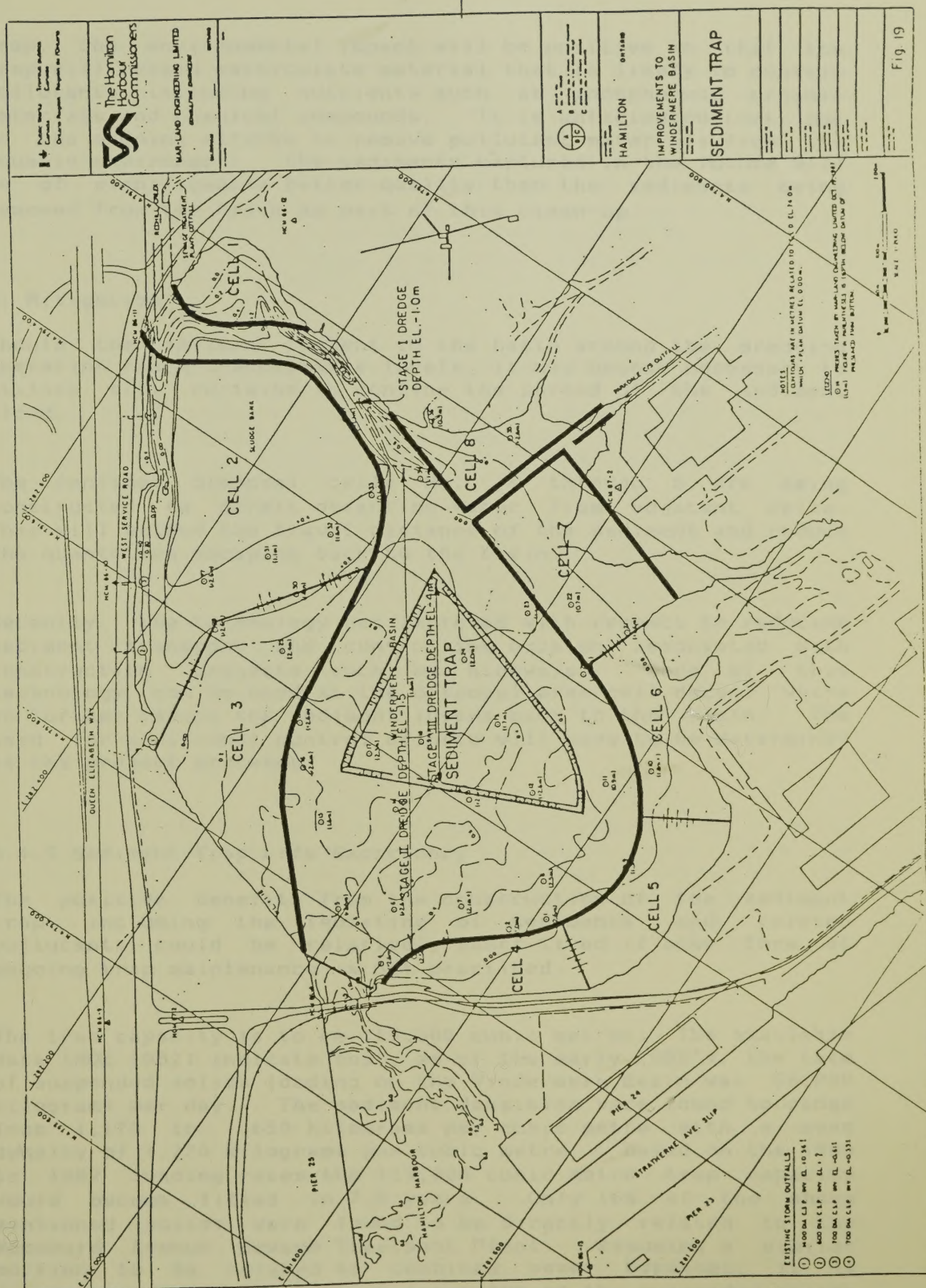
The disposal cells No. 4 through 8 will be used as the confined disposal areas for the sediments that will be dredged to construct the sediment trap in the open water portion of the basin. During this period of dredging, the water flow will be through the work area.

6.4.1 Flow Diversion To Central Basin

The temporary berms that completed the stage 2 flow diversion channel, including the berm south of the water level control structure from the east shore of the basin to the north end of the south and westerly containment berm and the berm connecting the west end of the northerly inlet channel berm to the easterly end of the south and westerly containment berm, will be removed to permit water flow to pass through the basin.

a) Environmental Impact

During the stage 2 work, the water flow was isolated from the work area. With the stage 3 work requiring the use of the disposal cells 4 through 8, the flow must be returned to the main basin. This will result in the movement of some sediment and contaminants, that have accumulated in the water column during the previous work, being displaced from the basin. The basin should be left closed for a period of time, if required, to permit the water quality to improve prior to opening the berms and permitting flow through the central portion of the



trap, the environmental impact will be positive in that the trap will retain particulate material that is likely to contain pollutants including nutrients such as phosphorus, organic materials and chemical compounds. It is anticipated that, due to the ongoing efforts to remove pollutant materials from the aquatic environment, the sediments captured in the future will be of significantly better quality than the sediments being removed from the basin as part of this clean-up.

b) Mitigation

Should the sediment content in the basin around the dredging operation reach unacceptable levels, it may become necessary to utilize silt curtains to confine the spread of the sediment cloud.

The confined disposal cells No. 4 through 8 are being constructed to permit decanting water from adjacent cells. This will extend the travel distance of the sediment and reduce the quantities escaping back to the basin.

Recently, the technology has improved with respect to reducing sediment transport and controlling erosion associated with construction projects such as highways. Some of this technology can be used at the disposal area cell decant weirs to further reduce the sediment losses back to the basin. The need for additional control efforts will have to be determined as the project proceeds.

6.4.5 Sediment Trap Life Expectancy

The positive benefits from the construction of the sediment trap including the isolating of sediments and related pollutants could be relatively short lived if some form of ongoing trap maintenance is not practiced.

The trap capacity is to be 113,000 cubic metres. The available data (MOE 1982) indicate that, as of the early 1980's, the rate of suspended solids loading on the Windermere Basin was 58,000 kilograms per day. The sediment densities were found to range from 1,170 to 1,650 kilograms per cubic metre with a mean density of 1,270 kilograms per cubic metre. Based on the 1980 to 1982 loading rates the 113,000 cubic metre trap capacity would become filled in 7.5 years. Only 16% of the above mentioned solids were found to be directly related to the Woodward Avenue Sewage Treatment Plant. Assuming a similar portion to be related to combined sewer bypasses, it is reasonable to assume that at least 70% of the suspended solids

The disposal cells No. 4 through 8 will receive hydraulically dredged material that is less polluted than the material that will go to cells No. 2 and 3. As before, the discharge points will be varied to optimize the filling of the individual cells while minimizing the amount of sediment carried back to the Windermere Basin. An attempt will be made to place the most contaminated sediment at the deepest sections of the disposal area. The filling of these cells will be undertaken such as to minimize the quantity of sediment placed in cell No. 4. This cell will be maintained with some reserve capacity to facilitate future sediment disposal.

6.5.2 Dewatering Sediment in the Confined Disposal Facilities

The sediment deposited in the confined disposal areas will have a high water content. This mix of sediment and water will take considerable time to decant to a sufficient degree to permit capping operations to commence.

The hydraulic fill will be placed to a level slightly below the top of the berms. Through a combination of evaporation and infiltration, the water will gradually separate from the sediment material enough to permit cover material to be placed on the disposal area. It is assumed that the dredge material will not be dewatered enough to permit capping material to be placed during the first winter after dredging. The schedule anticipates capping operations during the early portion of 1990 when the surface material is frozen enough to support equipment.

It may be possible to place a network of dewatering pipe to accelerate the decanting process by pumping water from the disposal area sediments after the sediment is placed and the initial decant is complete. If a pumped dewatering process is used, the pump effluent could be discharged to cell No. 4 where natural process will reduce the contaminants to acceptable levels for discharge to the basin.

6.5.3 Capping Confined Disposal Facilities

After the disposal area has been dewatered and allowed to consolidate for a period of time, the cover material can be placed during winter conditions while the sediment surface is frozen. The anticipated timing for capping is early 1990. The earth material will be placed from the perimeter and internal berms. The material will be pushed toward the centre of each cell using a bulldozer. The speed of capping will be controlled by the rate of frost penetration into the capping material as it is placed.

The nature of the Windermere Basin sediments are such that a prolonged period of several years will be required after capping before the disposal areas are stabilized to the degree that they will support significant weight.

6.6 PROJECT SCHEDULING

It is estimated that the contract for the project can be awarded by September of 1988. This would facilitate construction commencing in October 1988. The stage 1 work could be completed during the fall of 1988 and the stage 2 work commenced. Stage 2 dredging would take place from December 1988 to March 1989. The cells No. 1, 2 and 3 would be dewatered through to the fall of 1989. The stage 3 berm construction and dredging would take place during the period from October to December 1989. Capping would be undertaken during January and February of 1990 and site clean-up and landscaping would be undertaken during the summer of 1990. A preliminary construction schedule is included in Figure 20.

7.0 ENVIRONMENTAL MONITORING

Previous investigations have verified that the sediments in Windermere Basin are contaminated. The nature of the sediment contaminants are such that special precautions are being taken in the design of the proposed clean-up program. An important component of the project is the monitoring program that is to be implemented as part of the ongoing environmental protection component of the clean-up. This program is discussed below.

7.1 PURPOSE OF WATER QUALITY MONITORING

The water quality monitoring program that is being included as part of the proposed project will define the before, during and post construction conditions upstream, within and downstream of the Windermere Basin.

The before construction information will be important as baseline reference data that will be used in association with during construction conditions to determine whether unexpected deterioration of the downstream waters is occurring. If so, a decision can then be taken as to whether additional control measures are required during the implementation of the project. The post construction data will verify the efficiency of the disposal area in isolating the deposited dredged material from Windermere Basin.

The principle sources of pollutant loadings to the Windermere Basin include the Redhill Creek, the Woodward Avenue Sewage Treatment Plant and the Parkdale Avenue combined sewer overflow. In addition to the normal daily loadings coming from the Redhill Creek and the sewage treatment plant, a major storm event or a process upset at the sewage treatment plant could generate a significant increase in pollutant loadings to the basin through combined sewer bypassing and/or deterioration of the sewage treatment plant effluent quality. The proposed monitoring program associated with the clean-up must be designed to identify changes attributed to variations in background loadings such as the above examples as distinct from loadings arising from the dredging operation.

The Ontario Ministry of Environment operates a monthly water quality monitoring program that includes the routine sampling of Redhill Creek upstream at Barton Street. Additionally, as part of the Hamilton Harbour Remedial Action Plan Study, the sampling frequency at this station was increased in July 1987 from monthly to weekly sampling. Previous sampling data from this location can provide the typical normal level and the

range over which water quality in Redhill Creek is likely to vary.

The Region of Hamilton-Wentworth operates a sampling program at the Woodward Avenue Sewage Treatment Plant. This program involves the daily collection of samples from the plant effluent that are analysed for BOD-5, total phosphorus and suspended solids with weekly sampling for free ammonia.

Discharge quality from the basin can be determined by sampling at the East Port bridge outlet from the basin.

In situ loadings arising from the contaminants in the sediment can represent a significant load on the basin. In the case of Windermere Basin there have been considerable investigations to identify the spatial distribution of the sediment within the basin and the contaminant distribution within the sediment. Therefore, before construction sediment sampling would serve little benefit. The more important component of sampling will be to establish the sediment quality in the Basin after the dredging work is completed.

The Ontario Ministry of Environment monitoring program for Redhill Creek involves the monthly sampling of the creek. The analysis from this program indicates that bacterial levels are consistently in violation of Ontario criteria. This plus the fact that a high percentage of flow through the Windermere Basin is from the sewage treatment plant makes the logic of bacterial sampling as part of the dredging monitoring program questionable.

Other parameters measured as part of the Redhill Creek monitoring include:

- | | | |
|--------------------|------------------|----------------|
| - total phosphorus | - total Kjeldahl | - phenols |
| - iron | - arsenic | - mercury |
| - chromium | - copper | - lead |
| - cadmium | - zinc | - sus. solids. |

With the exception of PCB and PAH analyses, the background levels for the parameters suggested for monitoring are available through the Redhill Creek monthly stream quality sampling program.

The results of the previous investigations into conditions in Windermere Basin (excluding the weekly RAP sampling) have been reported (MOE 1982, Envirosearch 1985). These studies have specifically presented information identifying conditions in the sediments in Windermere Basin. The previous information

range over which water quality in Redhill Creek is likely to vary.

The Region of Hamilton-Wentworth operates a sampling program at the Woodward Avenue Sewage Treatment Plant. This program involves the daily collection of samples from the plant effluent that are analysed for BOD-5, total phosphorus and suspended solids with weekly sampling for free ammonia.

Discharge quality from the basin can be determined by sampling at the East Port bridge outlet from the basin.

In situ loadings arising from the contaminants in the sediment can represent a significant load on the basin. In the case of Windermere Basin there have been considerable investigations to identify the spatial distribution of the sediment within the basin and the contaminant distribution within the sediment. Therefore, before construction sediment sampling would serve little benefit. The more important component of sampling will be to establish the sediment quality in the Basin after the dredging work is completed.

The Ontario Ministry of Environment monitoring program for Redhill Creek involves the monthly sampling of the creek. The analysis from this program indicates that bacterial levels are consistently in violation of Ontario criteria. This plus the fact that a high percentage of flow through the Windermere Basin is from the sewage treatment plant makes the logic of bacterial sampling as part of the dredging monitoring program questionable.

Other parameters measured as part of the Redhill Creek monitoring include:

- | | | |
|--------------------|------------------|----------------|
| - total phosphorus | - total Kjeldahl | - phenols |
| - iron | - arsenic | - mercury |
| - chromium | - copper | - lead |
| - cadmium | - zinc | - sus. solids. |

With the exception of PCB and PAH analyses, the background levels for the parameters suggested for monitoring are available through the Redhill Creek monthly stream quality sampling program.

The results of the previous investigations into conditions in Windermere Basin (excluding the weekly RAP sampling) have been reported (MOE 1982, Envirosearch 1985). These studies have specifically presented information identifying conditions in the sediments in Windermere Basin. The previous information

has confirmed that the sediments are highly contaminated and that the sediments are prone to scour during periods of high flows. The previous studies have also identified water quality trends across the basin. The existing information in these studies can be used to provide benchmark water quality information.

7.2 BEFORE CONSTRUCTION MONITORING

Background water quality conditions for dry and wet weather flows can be estimated using ongoing monitoring data and previous studies. These conditions would then be used as baseline data against which water quality can be measured during the dredging process.

Two sets of water quality data, one dry weather and one wet weather, should be collected for comparison with the routine monitoring and previous studies data prior to the commencement of any berm construction or dredging activity.

The two sets of water samples should be collected from Redhill Creek upstream from the Woodward Avenue Sewage Treatment Plant effluent plume, within the effluent plume and downstream from the Windermere Basin at the East Port Bridge. The samples collected should be analysed on a total sample basis for:

- | | | | |
|--------------------|------------------|-------------|--------|
| - total phosphorus | - total Kjeldahl | - phenols | - lead |
| - iron | - arsenic | - mercury | - PCB |
| - chromium | - copper | - turbidity | - PAH |
| - cadmium | - zinc | - sus. sol. | |

Turbidity levels should be established at the two upstream locations and the downstream East Port Bridge location prior to any construction work commencing. MOE will collect 3 sediment samples from within the Basin for PAH analyses before dredging commences. Samples will be collected during July or August 1988.

7.3 DURING CONSTRUCTION

Turbidity measurements should be taken daily when construction or dredging activities are underway. The measurements should be taken at the two upstream locations (Redhill Creek and the STP effluent plume) and downstream at the East Port Bridge. Reductions in the frequency of the monitoring schedule may be possible after the work is underway and construction conditions are established.

Preferably the turbidity measurements should be taken using a calibrated meter as compared to using in-place meters. The potential problem with in-place meters is that the electrodes are prone to become coated with silt and render false readings unless a continuous cleaning and calibration program is instituted.

Once construction starts, in the event there is a specific problem indicated by high turbidity measurements during the clean-up, samples should be collected at the two upstream locations and the East Port Bridge location. These samples should be preserved and held as a precaution in the event that there is some specific problem identified, in which case the appropriate samples could be analysed to determine the conditions at the time of the problem.

Water chemistry samples should be taken at the East Port Bridge during the Stage 1 construction of the control weir, during the Stage 1 berm construction, during the Stage 2 berm construction, during the initial phase of the Stage 2 dredging and during the Stage 3 clean-up dredging prior to the removal of the control weir. The samples should be analysed for:

- | | | | |
|--------------------|------------------|-------------|--------|
| - total phosphorus | - total Kjeldahl | - phenols | - lead |
| - iron | - arsenic | - mercury | - PCB |
| - chromium | - copper | - turbidity | - PAH |
| - cadmium | - zinc | - sus. sol. | |

Sample collection and turbidity measurements will be taken by the engineering inspector on the job site for the project. The Ontario Ministry of Environment and Environment Canada will assist in training the engineering inspector the required sampling and measurement protocols. Samples are to be taken at mid-depth.

7.4 POST CLEAN-UP

Following the completion of clean-up operations, samples should be collected at the two upstream and the downstream sampling sites once a month (under steady state conditions) for 6 months. These samples should be analysed on a total sample basis for:

- | | | | |
|--------------------|------------------|-------------|--------|
| - total phosphorus | - total Kjeldahl | - phenols | - lead |
| - iron | - arsenic | - mercury | - PCB |
| - chromium | - copper | - turbidity | - PAH |
| - cadmium | - zinc | - sus. sol. | |

In addition to the water quality samples indicated above, a set of 25 surface sediment samples should be collected from the basin following the clean-up. A minimum of 5 samples (located at strategic points in the basin) will be analysed. The sediment samples will be analysed for the standard dredging parameters including phenols and PAH.

7.5 BERM MONITORING

Following the construction of the berms, a number of level markers should be set along the berms and levels surveys should be undertaken regularly during the work period to check settlement rates along the length of the berms. This data should be recorded and plotted to track settling rates in the berms. After the completion of the clean-up, the berm levels surveys should continue as required for a minimum of one month at which time a decision can be made as to the required frequency for ongoing berm level measurement. The berms should also be inspected for signs of failure or leakage.

Three piezometers should be installed in each of the north and the south disposal area containment berms following completion of the dredging. These piezometers will be available for monitoring by appropriate agencies to measure the post clean-up movement of contaminants in the berms.

8.0 ENVIRONMENTAL IMPLICATIONS

The proposed work will involve the clean-up of the Windermere Basin with one environmental cost being the reduction of the basin from a surface area in the order of 47 hectares to approximately 22 hectares. However, this reduction in area is offset by the increase in basin volume at the 74.4 metre low water level from in the order of 231,000 cubic metres to 526,000 cubic metres, an increase of 295,000 cubic metres or 128%. At the 74.9 metre high water level, the increase in volume is from 495,000 cubic metres to 634,000 cubic metres or 28%. The volume increase is an environmental benefit offsetting the surface area reduction.

8.1 SUPPORTING REMEDIAL MEASURES

Following the clean-up work when the contaminated sediments have been isolated from the aquatic environment, there will be a need to take action to minimize the sediment and contaminant loading that will continue to accumulate in Windermere Basin. To accomplish this, it will be necessary to implement programs to intercept contaminants currently entering both Redhill Creek and Windermere Basin. Programs will be required to eliminate additional combined sewer overflows, and to ensure that all liquid wastes receive adequate treatment prior to being discharged to the environment.

The Hamilton-Wentworth Region and the City of Hamilton have commenced the development of programs aimed at reducing combined sewer overflows and improving stormwater management. These programs will be required to offset the rate of increase in stormwater runoff due to urbanization. For instance, increases of 15 to 47 percent in the peak flows in Redhill Creek are likely to occur (Stormwater Management Study of Redhill Creek Watershed, City of Hamilton: prepared by Phillips Planning and Engineering) as urban development occurs within the watershed.

One area of major concern is the management of soils in the Redhill Creek watershed. This includes farmland in the upstream areas as well as other rural and urban properties. Without improvements in sediment control, over 70% of the present sedimentation occurring in Windermere Basin will continue. It will be vital that agencies such as the Ontario Ministry of Agriculture and Food and the Hamilton Region Conservation Authority enhance their efforts to reduce the upland erosion problem. In addition, the Region of Hamilton-Wentworth and the City of Hamilton and Town of Stoney Creek must deal with erosion from construction and urban development

sites. If sediment loadings to the Windermere Basin are to be reduced to permit the Windermere Basin to survive into the long term future following the proposed basin clean-up, erosion management must receive more emphasis.

Much of the Redhill Creek watershed is already urbanized, however, the upstream farmlands should be managed using conservation practices to minimize erosion losses as long as they are farmed. Once these lands are incorporated into development programs to support urban growth in the Hamilton and Stoney Creek areas, it will become important that the developers are made to employ construction techniques associated with housing and commercial development to reduce minimum sediment loss. Public projects such as the north-south expressway should also be required to ensure minimum sediment losses to Redhill Creek and ultimately Windermere Basin. Assuming that these conditions can be met, the eventual sediment loss rates to the Windermere Basin after the Redhill Creek is fully developed (probably after the year 2010) could reduce to less than 10% of the current loss rate.

The programs to clean up the discharge of sediment and contaminants to the Redhill Creek and Windermere Basin are essential in order to avoid the need for future removal of contaminated sediments from the Basin when the disposal of dredged sediments will present an even greater challenge.

8.2 WILDLIFE HABITAT

Windermere Basin supports a population of waterfowl. During the wintertime, due to the open water resulting from the discharge of warm sewage treatment plant effluent, a significantly larger flock of waterfowl overwinter in the area. The discussions that have been undertaken with various agencies included requests from wildlife interests to have the basin modified to include gradual bottom slopes to permit the establishment of aquatic plants in an environment that would be conducive to waterfowl populations.

A possible concern with the waterfowl use of Windermere Basin is that sewage treatment plant effluent could contain substances that could prove to be deleterious to the health of waterfowl. The previous discussion in section 5.7 Functional Linkages Between Sediment, Water and Biota discusses the establishment of waterfowl habitat after a period of monitoring following the completion of this project.

As discussed in Section 5.7, after the project is completed and all berms, slopes and bottom contours are finalized and stable,

including the construction of any spur dykes that may be required to tune the basin for trapping sediment, and following the completion of wildlife monitoring studies, it should be possible to design and construct slopes to accommodate waterfowl assuming the monitoring studies confirm the viability of the concept. The type and location of slopes could then be determined based on information gathered from the post clean-up wildlife monitoring program. This could include the use of any spur dykes placed in the basin for flow control. Such dykes may be able to serve a secondary waterfowl habitat function by the addition of material to provide the desired slopes behind the dyked areas that will support both submergent and emergent aquatic plants.

8.3 FISH HABITAT

The Department of Fisheries and Oceans Canada and the Ontario Ministry of Natural Resources also have a desire to see the possible use of the Basin for a future fish habitat. There is a need for a post clean-up monitoring program to confirm the suitability of the rehabilitated basin to support a healthy fish population.

As per the proposed clean-up, the basin is not likely to support a significant number of fish. However, as sedimentation occurs and the basin assumes its post clean-up naturalized configuration, it is anticipated that underwater sediment shoals will develop and areas of the basin will begin to support submergent plant growth that could contribute to the required habitat to promote the establishment of a fishery.

The habitat requirements to establish a fishery is seen to be more complex from the engineering viewpoint than for establishing a waterfowl habitat.

8.4 FUTURE USE

The proposals for the clean-up of the Windermere Basin have included discussions as to methods of enhancing the attractiveness of the basin to wildlife. The present project does not include any funding allowance for these future modifications. However, general estimates indicate that a program of shoreline modification to provide waterfowl habitat could require a budget allocation in the order of \$100,000. The conditions for bottom contour enhancement for fish is most likely to be provided over time from sedimentation. No estimate has been developed for fishery habitat enhancement.

Wildlife habitat could be developed as a component of the Hamilton Harbour Remedial Action Plan.

The end use of the confined sediment disposal areas is not addressed herein in that land use is governed by appropriate planning and zoning restrictions controlled by others. The applicability of City and Region planning restrictions would also depend on the nature of any proposed future use of the confined sediment disposal areas. Furthermore, the use of the confined sediment disposal areas may have to be restricted as to potential uses by Environment Canada as a result of environmental concerns, depending upon the characteristics of the sediments placed in the facility. Environmental restrictions could be a major concern in setting end use criteria.

It is recognized that there is concern by the City of Hamilton as to the future appearance of Windermere Basin in that the Basin is one of the principle gateways to the City. This concern is also shared by the Hamilton Harbour Commissioners in that Windermere Basin is the principle gateway to the Hamilton Harbour Commissioners' East Port.

While no plans are being made for the future use of the confined sediment disposal areas, there is a plan to landscape the areas following the project completion (after capping). This will provide an interim greenspace pending a decision as to the ultimate land use.

9.0 PUBLIC CONSULTATION PROGRAM

As part of the Initial Environmental Assessment Study, a public consultation program was developed. The program involved discussions with the stakeholders for the Hamilton Harbour Remedial Action Plan Study at a meeting plus two information sessions for the public. Presentations were made by individuals representing the proponent and the principle participants in the development of the project.

The stakeholders meeting plus an afternoon and an evening information session for members of the public were held at the Hamilton Yacht Club on June 7, 1988. The stakeholders were given notification through the facilitator for the stakeholder group. The open house sessions were announced on May 12 at a Remedial Action Plan public meeting (approximately 200 attendees) held in the Hamilton Convention Centre. The public sessions were also advertised in the May 28 and June 4 notice page of the Hamilton Spectator, a copy of which is enclosed in Appendix A. In addition, an article in the June 1, 1988 Hamilton Spectator (see Appendix A) also discussed the June 7 information sessions. The media was advised independently of the June 7, 1988 sessions.

Attendees at the June 7 stakeholders meeting and public information sessions were asked to register at the door. Registered participants at the stakeholders meeting included 28 individuals of whom 4 were officials of Environment Canada or the Ontario Ministry of the Environment and were directly involved in the project development. Registered attendees at the afternoon information session included 4 persons. Registered attendees at the evening information session included 11 persons. In total the sessions attracted 28 stakeholders and 15 persons from the general public. The public persons included 4 persons representing the media.

Despite the sparse attendance at the information sessions, there was a considerable discussion of the project with extensive questioning of the presenters.

In addition to the above public information sessions, on May 25 and 31, 1988, there were sessions for agency representatives and personnel involved in the project to view the hydraulic model of Windermere Basin that was developed and tested at the Canada Centre for Inland Water.

9.1 STAKEHOLDERS MEETING

Discussions at and comments arising from the stakeholders meeting identify several distinct viewpoints. Some stakeholders expressed the opinion that the proposed project did not go far enough in the clean-up of contaminants. Subsequent to the meeting, a number of stakeholders forwarded written comments that support the concept being proposed for the clean-up. The discussions at and comments arising from the stakeholders meeting are presented below.

9.1.1 Opening Presentation By Proponent Agency Representatives.

The following is a summary of presentations made by the proponent agency representatives.

- existing conditions were discussed, including the fact that the basin was near capacity and that contaminated sediments were likely passing through into Hamilton Harbour.
- the visual aids present were used to illustrate the poor image that the Basin presents at the north-east entrance to Hamilton. Specifically, sludge banks and debris contribute to a poor aesthetic condition.
- the project goal to promote rehabilitation through the removal of contaminated sediments was presented. Conditions would then be suitable to facilitate the establishment of a healthy mix of flora and fauna over a period of time.
- to accomplish the clean-up, contaminated sediment would be removed from a 22 hectare open water area and be deposited in confined sediment disposal areas.
- the confined sediment disposal areas are designed to prevent the loss of contaminants back into the Windermere Basin and Hamilton Harbour.
- to complement the clean-up there is a need to implement programs of upstream controls to minimize erosion and prevent combined sewer overflows in the Redhill Creek watershed.
- the future rehabilitation of the wildlife including the fishery and waterfowl was discussed. Following the completion of this project, it would be possible for the appropriate authorities to monitor conditions and develop suitable programs for the modification of Basin shorelines to develop wildlife habitat.
- details of the project, including the staging of activities, were discussed. The staged construction approach using a temporary weir to elevate water levels will make it possible

to minimize the loss of contaminants to the basin.

- the project would be staged over two years.

9.1.2 Stakeholders Concerns and Agency Representatives Response

The following is a summary of the discussions at the stakeholders information session.

- the displacement of contaminants during the berm construction.

The timing of work during low flow periods would provide some protection to minimize this risk.

- the creation of useable land and the location and future use of this land.

The confined disposal areas would eventually become useable but only after a period of possibly 10 or more years. This would provide adequate lead time for the agencies to come to agreement on the land use.

- the sediments should be decontaminated prior to disposal.

The available technology is not adaptable to Windermere Basin conditions. The cost is prohibitive. The use of confined sediment disposal areas is accepted practice.

- the sediments might seep out of the confined disposal areas into the Basin or the groundwater.

The contaminants are bound to fine particles that would be prevented from moving through the berms.

- the type of material that the berms would be constructed from.

The material was from pre-screened sources and is acceptable to environmental enforcement agencies for berm construction.

- how to prevent wind erosion of contaminants from the dewatered sediments in the confined sediment disposal areas prior to capping the site.

The sites would be monitored and wetted as required to prevent excess drying and dust movement.

- PAH's in the sediments.

The sediments would be checked for the presence of PAH's.

- putting sediments in confined disposal areas is like sweeping dirt under the carpet.

NO! It will be handled in the most appropriate manner. The techniques to be used are approved by the environmental enforcement agencies.

- the final contouring and surface treatment for the confined disposal areas.

The surface would be generally flat with natural vegetation and positive drainage.

- the nature of the confined disposal areas capping material.

The areas would be capped with clean material.

- who would be responsible for the confined disposal areas and the Basin.

The proponents, the Hamilton Harbour Commissioners.

- use in situ leachate testing to determine contaminant mobility.

The standard accepted testing was used to evaluate the sediment contaminants.

- better to cover the contaminated sediments with cement and raise the water level with a dam.

Technically impractical. The cement cost would be high and the permanently raised water levels could risk flooding upstream along the Redhill Creek.

- the upstream sources should be stopped first.

This is already underway through programs being undertaken by Hamilton-Wentworth to eliminate combined sewer overflows and improve sewage effluent quality.

- no provision for monitoring the flora and fauna during and after construction.

During construction flora and fauna will likely be seriously impacted and after construction monitoring should be integrated into other monitoring programs as part of the Hamilton Harbour Remedial Action Plan Studies.

- gently sloped berms should be constructed to provide habitat for flora and fauna.

Building gentle slopes now would make the contaminant clean-up more difficult and less thorough. There would

be no savings to build the slopes now compared to after the project is completed.

- what will be done with future sediment accumulations.

There will be limited additional storage for future contaminated sediments but it is anticipated that in future the sediments will be cleaner. Clean sediments could be left to form littoral zones for fish and waterfowl.

- build a confined disposal area in an island configuration.

Islands require extra berm material and take up additional water surface thereby reducing the Basin area further plus additional berm length is exposed to the Basin.

- confined disposal areas built smaller and higher.

The material going into the confined disposal areas is initially not stable and therefore does not have the structural strength to build higher.

- can interveners ask for a panel hearing under the EARP?

In case of significant unresolved environmental issues and public concerns, under the Federal Environmental Assessment and Review Process the proponent could decide to go to a hearing.

9.1.3 Written Comments From Stakeholders Meeting

Following the stakeholder meeting a number of additional written comments were received. Comments not previously discussed are presented below.

- the proposal is seen to be relatively sound and should proceed as soon as possible.
- berm material could come from the cleaner sediment trap material.

The above suggestion is not practical to implement in that the berms must be constructed first to have a containment area for the contaminated sediment, but, the sediment trap material cannot be dredged until the contaminated sediment is excavated.

- the broader issues of contaminated sediment inputs into the Harbour should be addressed, however, the project should proceed for the reason that it is a visible way in which the Harbour clean-up can register with the general public.

- the end use of the project should be to enhance the area for public usage for wildlife habitat.

- the alternate development of a tertiary treatment marsh might be worth the additional cost.

This was ruled out by the Windermere Basin Technical Advisory Committee in the initial project selection.

- the proposal is the best with the available money and the design allows for further refinements as experience and evaluation is carried out in the future.

A list of the attendees and the written responses are presented in Appendix A. The appendices are available upon request.

9.2 AFTERNOON DROP-IN INFORMATION SESSION

The afternoon drop in session generated a number of questions relating to the proposed concept. One inquiry related to the manner in which the modifications to the Basin would impact a nearby private enterprise. Several questions arose as to the possibility of providing wildlife habitat as part of the project.

A list of the attendees and the written responses are presented in Appendix A. The appendices are available upon request.

9.3 EVENING PUBLIC INFORMATION SESSION

The evening Public Information Session commenced with an opening presentation similar to the presentation at the morning stakeholders session. Citizens concerns and the responses by the proponent agency representatives are summarized below:

- relate Windermere Basin clean-up to other projects.

The Windermere Basin clean-up is a separate environmental project within the broader concept of the Hamilton Harbour ecosystem.

- what controls on future inputs.

This project is to remediate existing environmental problems. Other agencies have responsibility to correct inputs.

- level of contaminants in the sediments.

Contaminants in the sediment are in the order of 20 to 50 times the accepted levels for open lake disposal.

- what type of public access.

The land use issue and the question of public access has been deferred as per the Windermere Basin Technical Advisory Committee recommendation.

- what guarantees for wildlife.

It is premature to plan for and accomodate wildlife at this stage of the project. Not ruling out wildlife.

- could one third of cost be saved by not dredging sediment trap.

No. The berms must be built for flow diversion. Sediment trap will extend life of basin and provide deep entrapment area until upstream sources controlled.

Following the public session a number of written comments were received. One additional written comment that was not addressed above suggested that fountains be installed in basin for re-aeration of the Basin water and for improved aesthetics.

A list of attendees and the written responses are presented in Appendix A. The appendices are available upon request.

Concerns from the public information sessions are summarized along with agency and organization concerns in section 11.0 Summary of Concerns.

10.0 CONSULTATION WITH ENVIRONMENTAL/REGULATORY AGENCIES

As part of the consultation program developed for this project, a series of meetings were held with environmental and/or regulatory agencies and organizations having an interest in the clean-up. These meetings included sessions with:

- Ontario Ministry of the Environment,
- Environment Canada,
- Fisheries and Oceans Canada,
- Ontario Ministry of Natural Resources,
- Hamilton Region Conservation Authority,
- Region of Hamilton-Wentworth,
- City of Hamilton,
- Hamilton Naturalist Club.

A letter was received from the Halton Region Conservation Authority. Telephone discussions were conducted with officials of the Canadian Wildlife Service.

Ongoing discussions were maintained with the Ontario Ministry of the Environment and Environment Canada as the principle regulatory agencies. Results of ongoing discussions with these two agencies are reflected in the text of this report.

The Ontario Ministry of Natural Resources, Fisheries and Oceans Canada and the Hamilton Naturalists Club all expressed similar concerns relating to wildlife habitat during meetings. The meetings with these parties are reported in sections 10.2 to 10.4.

10.1 REGION, CITY AND CONSERVATION AUTHORITY CONCERNS

During meetings with the Hamilton Region Conservation Authority, the City of Hamilton and the Regional Municipality of Hamilton-Wentworth, concerns were expressed that the future use for the confined sediment disposal areas was not being specified as part of the clean-up. The City of Hamilton and Hamilton-Wentworth Regional planners expressed concerns regarding the future aesthetics of the Windermere Basin in that the area was seen as a gateway to the City. The project plans for landscaping following the dredging were discussed. There was no implied violation of City or Regional official plans or zoning by-laws during the discussions with the municipal planners. The future land use issue was left for the parties to resolve following the completion of the project.

10.2 FISHERIES AND OCEANS CANADA MEETING

The meeting was held on June 16, 1988 at the Canada Centre for Inland Waters. Attendance included:

Fisheries and Oceans Canada

Dr. Harvey Shear
Dr. John Cooley
Dr. Vic Cairns
Dr. Ken Minns
Dr. Janet Elner

Project Team

Mr. Bob Edwards (HHC)
Mr. Peter Does (PWC)
Mr. Ansar Khan (PWC)
Mr. Gary McFarlane
(Mar-Land)
Mr. Glen Pearce
(Envirosearch)

Environment Canada

Mr. Simon Llewellyn
Ms. Janet Huehn.

Concerns expressed by Fisheries and Oceans Canada with respect to the rehabilitation of Windermere Basin were discussed. These concerns were previously provided in the form of a position paper circulated to the Hamilton Harbour Remedial Action Plan Stakeholders by Dr. C. K. Minns and a letter to Public Works Canada signed by Drs. J. M. Cooley and H. Shear. These letters are included in Appendix B.

The following presents the concerns being addressed and the response to these concerns.

- Fisheries and Oceans Canada suggested an ecosystem approach be followed that would consider all impacts of the project on Hamilton Harbour.
- Fisheries and Oceans Canada recognize that the Windermere Basin clean-up is based on the need to isolate the contaminated sediments in the Basin from the aquatic environment. However, concern was expressed that the project may not be taking into consideration the long term goals of Hamilton Harbour. This concern was founded on the perceived need to conduct future dredging after sediment had accumulated again in the Basin. This second round of dredging would require additional confined sediment disposal capacity, presumably located in the littoral zone of the Harbour.

The existing programs to deal with upstream sources are beginning to reduce the contaminant loading on the Basin. In addition, the sewage treatment plant effluent quality is improving. These factors will contribute to reducing the contaminant burden on Windermere Basin and hence should result in improved future sediment quality thereby reducing the need for future dredging and related confined sediment disposal areas. This should

therefore not result in the need for additional confined sediment disposal areas in Hamilton Harbour and subsequently the loss of further littoral zone habitat.

- The basin, when deepened, will be more like an estuary environment and hence will attract fish. These fish will also travel to other areas of the Harbour and contribute to the food chain.

The sediment clean-up will reduce the quantity of contaminants in the Basin and hence should reduce the impact on the fishery. Some contaminants such as PAH's are likely to remain in the sewage treatment plant effluent.

- There is a need to preserve the littoral zones around the harbour. Therefore, the Basin should not be deepened to destroy its future potential as fish habitat.

As there is no need to dredge to navigation depth, the Basin deepening will be minimal with a littoral zone around the perimeter and a deeper sediment trap near the centre area. There will still be a shallow water environment that with time will become shallower due to sediment deposition.

- Assuming that sediment quality is improved, there will be a need to create future fish habitat in the Basin as the fluvial nature of the Basin, plus the warm water and nutrients from the sewage treatment plant will attract fish.

- The nature of habitat requirements for fish differs from the nature of habitat requirements for waterfowl.

The cost to construct sloping bottoms and provide the required fish habitat would be well beyond the existing project budget. However, the Windermere Basin will not be a static creation once that it is dredged. There will be a continuously changing environment within the Basin due to a degree of ongoing sedimentation that will create submerged shoals and sloped bottoms to form habitat that should be suitable for fish.

A number of possible future modifications to the basin can be undertaken when the need is seen. These could include the modification of a portion of the shoreline environment (primarily for waterfowl) but providing some complementary benefit for fish. This type of modification is likely to cost in the order of \$100,00.

There are also alternatives such as the construction of spur dykes that would extend the residence time of the water in the Basin. The cost for this type of installation could reach \$350,000. Some information on these alternatives is presented in Appendix C.

The project team concerns relate to the fact that the sewage treatment plant will continue to discharge some contaminants after the dredging project is complete. The question arises as to whether the waters of Windermere Basin will be suitable for fish without jeopardizing the fishery elsewhere in the Harbour. Should the Basin not pose a hazard to fish, then the habitat creation could be undertaken.

- Fisheries and Oceans Canada do not have information as to the suitability of the basin for fish following dredging.
- The question of what comprises a suitable fishery habitat arose.
- A fishery habitat in Windermere Basin would preferably have a littoral zone less than 2 metres in depth with gentle bottom slopes possibly in the order of 1:5 and an irregular shoreline. The surface should consist of soil material that will support aquatic plant growth. A minimum of rock rip rap is desired.

Generally, the basin will be in the order of 2 metres deep around the shore perimeter with approximately 4.5 metres depth in the central sediment trap area. With time, these depths will change due to natural sediment deposition. Natural sediment deposition may be a possible way of resolving the problem of creating a fishery habitat in that layers of sediment will be laid down creating varying depths throughout the Basin.

- Fisheries and Oceans Canada was concerned that the project was seen to preclude habitat construction.

The current project does not have a budget to create habitat after the contaminated sediments are removed. The proposed work will not prevent the future placement of modifications to enhance fish habitat.

- Fisheries and Oceans Canada support the concept to remove contaminated sediment but would prefer to see habitat created immediately.

It was indicated that the Basin should be monitored to determine any problems related to the creation of fish habitat following the completion of the project. However, the project has a funding limitation on part of the financing imposing a time limit of March 31, 1990. Hence, monitoring would have to proceed following the dredging project but separately.

- Fisheries and Oceans Canada asked whether sediment would be allowed to accumulate in the basin if it was found to be clean.

It is anticipated that there could be a need for one more dredging of some contaminated sediment but if these or later sediments prove to be clean, there would be no need for a clean-up dredging. There is no need to dredge in the Basin for navigational purposes.

It was suggested that after the completion of the project, if nature were allowed to take its course, a suitable habitat may develop through sediment deposition in the Basin. If not, future modifications would still be possible.

- Fisheries and Oceans Canada want to extend the timeframe for the project indefinitely to facilitate fishery monitoring and the possible development of fish habitat.

- the Environment Canada representative suggested that this request was not possible, but, the five funding partners should meet to explore the possibility of extending the terms of reference to accomodate the Fisheries and Oceans Canada request. This would, however, not effect the preparation of the Initial Assessment Report or the completion of the proposed project.

10.3 ONTARIO MINISTRY OF NATURAL RESOURCES MEETING

The meeting was held on June 17, 1988 at the Ontario Ministry of Natural Resources Cambridge office. Attendance included:

Ontario Natural Resources

Mr. Peter Meerveld
Ms. Nancy Tilt
Mr. Larry Halyk

Environment Canada

Ms. Janet Huehn

Project Team

Mr. Bob Edwards (HHC)
Mr. Ansar Khan (PWC)
Mr. Gary McFarlane
(Mar-Land)

Mr. Glen Pearce
(Envirosearch).

The meeting was arranged to discuss concerns expressed by the Ontario Ministry of Natural Resources with respect to the rehabilitation of Windermere Basin. These concerns were provided in the form of a letter to Public Works Canada signed by Mr. Craig Selby. The letter is included in Appendix B.

The following presents the concerns raised and the response to these concerns.

- The Ontario Ministry of Natural Resources expressed concern that existing habitat should be restored.

The proposed project will enhance the quality of the existing habitat. The concern was related to the belief that the Basin shore would be lined with rip rap which would be unsuitable habitat. In accordance with the proposed design, only portions of the shore near the inlet and to a lesser degree near the outlet would be armoured with rip rap. Other areas would be common earth fill that would be allowed to vegetate naturally with grasses and other plants.

- The Ontario Ministry of Natural Resources expressed concern that no long term use was defined for the confined disposal areas.

It was indicated by the proponent that appropriate agencies would be consulted regarding their input to the land use question through discussions with Environment Canada.

- The Ontario Ministry of Natural Resources expressed concern that there could be considerable loss of sediment to the Harbour during the flow diversion stages of the project when dredging was underway.

The proposed project will mitigate potential sediment loss through the use of the water level control weir which will increase the Basin volume and consequently decrease flow velocity during construction. Bed load sediment is expected to accumulate near the weir.

- The Ontario Ministry of Natural Resources is not interested in relocating wildlife prior to commencing the project.
- The Ontario Ministry of Natural Resources was concerned regarding the eventual shoreline configuration and its suitability for wildlife habitat.

It should be possible to modify slopes to provide wildlife habitat after this dredging project is completed.

The discussions were concluded with the general concurrence that the concerns expressed by the Ontario Ministry of Natural Resources could be mitigated within the project concept.

In a letter dated June 23, 1988, a copy of which is included in Appendix B, the Ontario Ministry of Natural Resources provided Public Works Canada with a summary of the discussions relating to the proposed project.

10.4 HAMILTON NATURALIST CLUB

Several discussions were held with representatives from the Hamilton Naturalist Club. The Club concerns were outlined and supporting information was provided to the project team by the Club secretary, Ms. Christine Bishop.

The Club position was presented at a meeting with Ms. Bishop on June 16, 1988. The Club had two major concerns relating to the biological significance of Windermere Basin and the creation of wildlife habitat. This report has since been revised to include information provided by the Club which reflects the biological significance of the Basin. The creation of wildlife habitat has been addressed and cost estimates prepared for possible implementation.

The information presented "Windermere Basin Proposal - Hamilton Naturalists' Club Recommendations" is included in Appendix B.

11.0 SUMMARY OF CONCERNS

The major concerns arising from the consultation program related to the following topics.

1 - Wildlife Habitat

- there were requests for the future development of wildlife habitat in Windermere Basin and on the adjacent confined sediment disposal area.

The project can proceed and the contaminated sediments in the Basin can be removed which should enhance the possible future development of wildlife habitat in the Basin.

2 - Land Use

- there were recommendations to have the future land uses adjacent to Windermere Basin defined before the clean-up proceeds.

The question of future land use will have to be addressed by the proponent. The ultimate use of the confined sediment disposal areas will be influenced by the quality of the sediments deposited in these areas.

3 - Source Control

- it was suggested that a comprehensive plan be developed that would deal with upstream pollutants at source.
- this lead to the question of future sediment management in the Basin.

The initial steps to develop programs to reduce upstream pollutants through the elimination of combined sewer overflows have been taken by the Region of Hamilton-Wentworth and the City of Hamilton. The reduction of erosion from rural land and from construction sites is a problem requiring considerable attention.

4 - Ecosystem Approach

- some individuals argued that the preceding concerns could only be handled adequately if dealt with through an ecosystem approach.

The ongoing Hamilton Harbour Remedial Action Plan Studies provide a forum for the development of an ecosystem approach to the long term management of the Windermere Basin and its related upstream and downstream environs.

11.1 FUTURE CONSIDERATIONS

As a result of the investigations undertaken to prepare this initial assessment, including the public and agency consultation programs, a number of items have been identified that should be considered in the future.

- 1 - The appropriate agencies should undertake to monitor the suitability of Windermere Basin for wildlife habitat. This would include monitoring for both fish and waterfowl. Additional information such as bedload sediment sampling in Redhill Creek would be beneficial in this regard.
- 2 - Discussions should be initiated between the proponent agency and interested parties for possible use of Windermere Basin as a wildlife habitat.
- 3 - Efforts to improve upstream source control related to combined sewer by-passing, land runoff and erosion should be increased to both reduce the quantity of sediment entering the Basin and minimize the contaminants in the sediment that does reach the Basin.
- 4 - Discussions should be initiated at an opportune time between the proponent and appropriate parties to resolve the concerns regarding the future land use for the confined sediment disposal areas.

REFERENCES

- Canadian Geographic June/July 1987. Cleaning Up Hamilton Harbour.
- Dillon, M.M. Limited for Hamilton Region Conservation Authority March 1975. Report on Redhill Creek Flood Mapping.
- Dobos R.Z. & Weseloh D.V. July, 1987. Waterbird Surveys of Hamilton Harbour and Windermere Basin, Lake Ontario, Autumn 1985 and 1986, Unpublished.
- Ecologistics Limited 1976. Hamilton-Wentworth Region Environmentally Sensitive Areas Study.
- Ecologistics Limited May, 1988. Hamilton Harbour Remedial Action Plan - Non-Point Source Loading Study. (Draft Report)
- Environment Canada - Ontario Ministry of Environment. Dialogue on Hamilton Harbour, Fact Sheets 1 to 6.
- Environment Canada - Ontario Ministry of Environment March, 1987. Dialogue on Hamilton Harbour, Issue #2.
- Envirosearch Limited for Ontario Ministry of Environment on Behalf of Windermere Basin Technical Advisory Committee April 15, 1985. Final Report: Windermere Basin Sediment Study, Evaluation of Alternatives for a Cleanup of Windermere Basin.
- Federal Environmental Assessment Review Office (FEARO) April, 1986. Initial Assessment Guide, Federal Environmental Assessment and Review Process.
- Greig L.A. & Jones M.L., Environmental and Social Systems Analysts Ltd. and Minns C.K., Department of Fisheries & Oceans, Great Lakes Fisheries Research Branch, Canada Centre for Inland Waters March, 1984. The Potential for The Rehabilitation of Hamilton Harbour: Results of A Meeting To Examine The Scope and Information Needs.

REFERENCES (Cont'd.)

- Holmes, J.A., Institute for Environmental Studies,
University of Toronto & Whillans, T.H.,
Environmental and Resources Studies, Trent
University for Department of Fisheries and Oceans
March, 1984. Historical Review of Hamilton
Harbour Fisheries.
- Holmes, J.A., University of Toronto, for Department
of Fisheries and Oceans, Great Lakes Fisheries
Research Branch, Canada Centre for Inland Waters
December, 1986. The Impact of Dredging and Spoils
Disposal on Hamilton Harbour Fisheries:
Implications for Rehabilitation.
- Inland Waters Directorate, Water Resources Branch,
Water Survey of Canada 1983. Historical
Streamflow Summary - Ontario.
- Mar-land Engineering Limited for Hamilton Harbour
Commissioners August 1984. Prefeasibility Study:
Proposed Improvements To Windermere Basin.
- McLarty, A.W. & Thachuk, A.G., Ontario Ministry of
Environment, West Central Region August, 1986.
Cootes Paradise Study.
- Ontario Ministry of Environment December 1980.
Guidelines For The Design Of Sewage Treatment
Works.
- Ontario Ministry of Environment, Technical Support
Section, West Central Region (MOE) December 1982.
Windermere Basin Study.
- Ontario Ministry of Environment, Water Resources
Branch (MOE) August 1985. Hamilton Harbour,
Technical Summary and General Management Options.
- Paragon Engineering 1983. Mountain East-West & North-
South Transportation Corridor (Supplementary
Documentation) Environmental Assessment
Submission.

APPENDIX - A

CONTENTS:

Public Information Session Advertisement, May 28, 1988

Newspaper Article, June 1, 1988

Newspaper Article, June 8, 1988

Attendees List, Stakeholders Meeting, June 7, 1988

Stakeholder Comments

Attendees List, Afternoon Session, June 7, 1988

Participant Comments

Attendees List, Evening Session, June 7, 1988

Participants Comments

THE SPECTATOR, SATURDAY, MAY 28, 1988 G5



The Hamilton
Harbour
Commissioners

WINDERMERE BASIN REHABILITATION PROJECT

ENVIRONMENTAL ASSESSMENT & REVIEW PROCESS

PUBLIC INFORMATION SESSION

A public information session about the upcoming Windermere Basin Dredging project will be held on 07 June 1988 at the Hamilton Yacht Club located at the foot of MacNab Street North in Hamilton, Ontario. The purpose of the session will be to answer any questions or address any environmental concerns members of the public may have regarding this project. The format of the session will be as follows:

3:00 p.m. - 7:00 p.m. - Drop-In Session
7:00 p.m. - 9:00 p.m. - Information Forum

Officials of the various agencies involved in this project will be on hand to answer any questions or concerns individuals or groups may have in this regard.

Copies of the draft environmental screening document will be available one week prior to the information session at the Central Library of the Hamilton and Burlington Public Libraries.

**THE HAMILTON HARBOUR
COMMISSIONERS
605 JAMES ST. NORTH
525-4330**

Windermere

JUNE 1/88
SPEC

dredging plan outlined

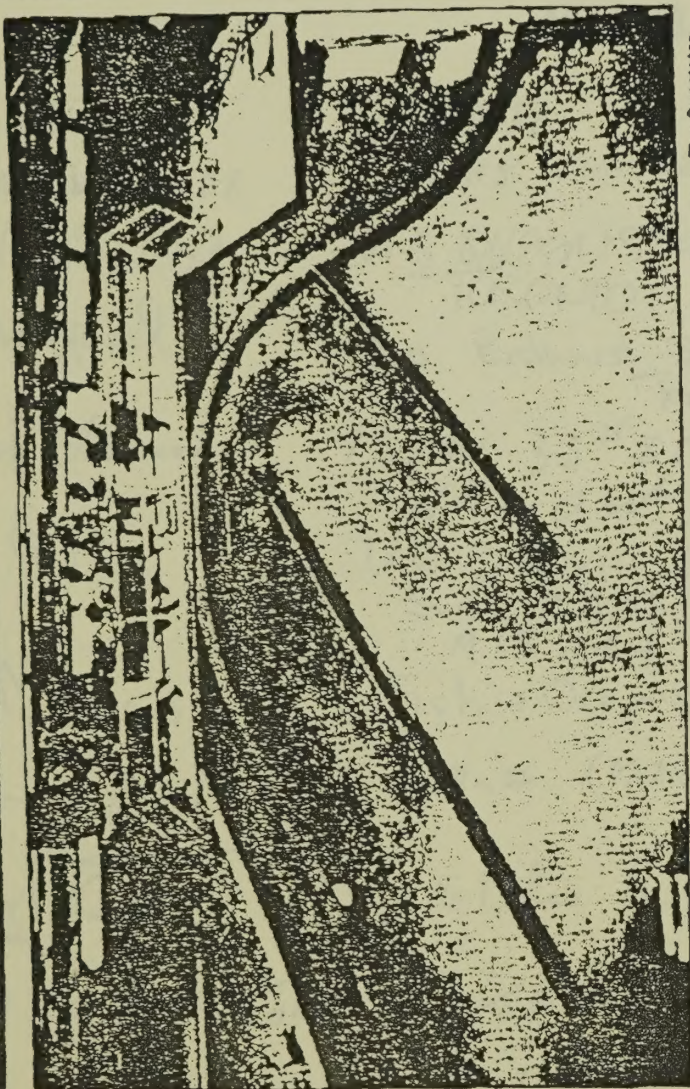
Report available this week

By ERIC MCGUINNESS
The Spectator

BY BUILDING a dam and dredging in stages, engineers say tonnes of polluted mud can be removed from Windermere Basin without toxic chemicals spreading to the rest of Hamilton harbor.

Plans for the dam and details of how the dredging would be done are outlined in a preliminary environmental assessment report on the proposed \$4.5-million basin clean-up.

The report, part of the federal environmental assessment and review process, is available for



Gary Yokoyama, The Spectator

Group watches a demonstration of water flow in a model of Windermere Basin.

Keep Windermere naturalist club

By BARBARA BROWN
The Spectator

MAINTAINING WINDERMERE Basin as a natural wildlife habitat should be part of the plans for a \$4.5-million basin clean-up operation, says a spokesman for the Hamilton Naturalists' Club.

But, while the interests of fowl and other wildlife were represented at a public meeting on the project at the Hamilton Yacht Club last night, only a handful of Hamilton and Burlington residents put in an appearance.

Up for discussion was a preliminary report, part of a federal environmental assessment and review process, which must be approved before any clean-up can begin late this fall.

Naturalists' club member Christine Bishop said the club supports dredging to move its contaminated mud, but said concerns about steep-walled berms at the edge of the wetland area unsuitable for a natural line fowl.

"Our concern is that the wildlife habitat is not being incorporated into this plan as a design use," said Ms Bishop.

She was responding to comments by Canada spokesman Ansar Khan that the basin is a natural-sloping area between land and water, and remained a simple and inexpensive follow-up dredging operation.

"Once the thing has been dredged, we will be costly to redesign and there may not be a will to redesign it as green space," Ms Bishop said.

Despite its contaminated sediment, the basin is a natural area.

Morning Stateholders

WINDERMERE BASIN REHABILITATION PROJECT ENVIRONMENTAL ASSESSMENT & REVIEW PROCESS PUBLIC INFORMATION SESSION

ATTENDEES LIST

<u>NAME</u>	<u>ADDRESS</u>	<u>PHONE NO.</u>
RICHARD WALKER	RR#5 SIMCOE, ONT	519 426-1796
SARAH MILLER	243 QUEEN ST W 4TH FLOOR TORONTO	(416) 977-2410
Sally Heppard	720 Bathurst St. Ste. 403. Toronto	(416) 536 9161
Jennis Leson	136 W. 35th ST Ham. Ont	385 6880
Marie Gillis	720 Bathurst St Suite # 403 Toronto M5S 2R4	536-9161.
Ken Manns	Fish + Oceans, CC 111	336-4874
Mike Amle-Jones	M. H. O. C. (Political Science dept)	525-9140
Hyd Elin	Stelco Inc.	637-3575
NORRI LOCKINGTON	DOFASCO	544-3761
Jane Anderson	West Burlington Citizens Group	634-4411
Karen Quinn	605 James St W.	549-8740
STAN IRWIN	MOE HAMILTON	521-7640
Pat Potter	NET Force	388-0768
CHUCK POTTER	ENVIRONMENTAL HAZARDS TEAM	388 0768
Paul Valenzuela	CC 111	336-4586
Mary Jones	C.H.O.C.	545-0977
Harry Griffith	B.S. & B.C.	416-637-3670
Janet Harkin	DOE - Toronto	911 975-5895

Morning - Stake holders.

WINDERMERE BASIN REHABILITATION PROJECT
ENVIRONMENTAL ASSESSMENT & REVIEW PROCESS
PUBLIC INFORMATION SESSION

ATTENDEES LIST

NAME

ADDRESS

PHONE NO.

<u>NAME</u>	<u>ADDRESS</u>	<u>PHONE NO.</u>
Mr. [Signature]	Procter & Gamble Inc.	545-1121 EXT 325
Peter Meerveldt	Ministry of Natural Resources	(519) 823-5285
Brenda Axon	Halton Region Cons. Auth	336-1158
ED. [Signature]	DOFASO INC	544-1121 X 6708
BOCC TANAKA	ENVIR CANADA	416-973-1009
IAN RICHARD	Pro Region of Hamilton /	526-4210
JOHN GARTNER	CCIW	416-336-4768
Chip Weseloh	DOFASO	336-4959
Ray Runkle	POB	
S. Claverton		

JUNE 8, 1988

Keep Windermere Basin for wildlife naturalist club tells clean-up probers

By BARBARA BROWN
The Spectator

MAINTAINING WINDERMERE Basin as a natural wildlife habitat should be part of the plans for a \$4.5-million basin clean-up operation, says a spokesman for the Hamilton Naturalists' Club.

But, while the interests of fowl and other wildlife were represented at a public meeting on the project at the Hamilton Yacht Club last night, only a handful of Hamilton and Burlington residents put in an appearance.

Up for discussion was a preliminary report, part of a federal environmental assessment and review process, which must be approved before the clean-up can begin late this fall.

Naturalists' club member Christine Bishop told project officials the club supports dredging the basin to remove its contaminated mud, but said containing the mud behind steep-walled berms at the edge of the basin would make the wetland area unsuitable for a number of shore-line fowl.

"Our concern is that the wildlife habitat goal is not being incorporated into this plan as a designated future use," said Ms Bishop.

She was responding to comments by Public Works Canada spokesman Ansar Khan that creating a littoral zone (a natural-sloping area between land and water) remained a simple and inexpensive follow-up option to the dredging operation.

"Once the thing has been dredged, we think it's going to be costly to redesign and there may not be the political will to redesign it as green space," Ms Bishop said.

Despite its contaminated sediment, the Windermere



Christine Bishop: concern

Basin is "a very significant habitat," containing a variety of birds, fish and turtles, Ms Bishop said following a panel discussion by consultants and representatives of the Hamilton harbor commission, Ontario Ministry of the Environment and Public Works Canada.

The naturalists' club is also concerned about the danger of further exposing wildlife to contaminants while the sediment is left to dry before covering it with a metre of clean fill, said member Rob Dobos.

But, environmental consultant Glen Pearce said wildlife is currently exposed to the most toxic levels of sediment, which occur at the top of the deposit.

The contained sediment would "de-water" within a few months and would include less toxic deposits found at deeper levels, thereby creating a diluting effect, he said.

Paul Muldoon, a member of a provincial environmental coalition called Great Lakes United, said project planners shouldn't interpret last night's poor turnout as a lack of interest by area residents in the basin, located at the eastern end of Hamilton harbor.

"This is a technical session and perhaps that doesn't appeal to everyone," he said.

Mr. Khan said later he was not disappointed with the attendance, adding it may signify Hamilton residents widely support the clean-up.

The report suggests building a dam at the mouth of the harbor to control water levels and prevent a spillover of toxic chemicals into the harbor while the centre of the basin is dredged in stages.

The heavily-contaminated sediment would then be stored in contained cells and topped with clean fill. The project is expected to take two years to complete.

WINDERMERE BASIN REHABILITATION PROJECT
ENVIRONMENTAL ASSESSMENT & REVIEW PROCESS
PUBLIC INFORMATION SESSION

COMMENTS FORM

NAME: RICHARD WALKER

ADDRESS:

RR #5
SIMCOE
ONTARIO
N3Y 4K4

PHONE: 519-426-1796

H
B

REPRESENTING:

SELF:

GROUP/ORGANIZATION: Ont. Federation of Agriculture

COMMENTS:

I believe that this proposal is relatively sound and
should proceed as soon as possible.

I am concerned with the future silting of the basin
from area construction sites, I believe that ~~stricter~~
controls should be incorporated to regulate and hopefully
eliminate erosion from construction and development
projects in the area which operate ignore this issue

Reference is made to: Ont. Ministry of Agriculture and
Food and the Conservation Authority who are jointly committed
to reducing soil erosion from agricultural land, they
are making excellent progress in this area

Another consideration might be to obtain berm
building material from the bottom of the basin (below the
present sediment) to provide for additional sediment
holding capacity of the basin.

NOTE:

ADDITIONAL WRITTEN COMMENTS WILL BE ENTERTAINED UP TO 14 DAYS
AFTER THE INFORMATION SESSION.

SEND YOUR SUBMISSIONS TO: PUBLIC WORKS CANADA
4900 YONGE STREET, 11TH FLOOR
WILLOWDALE, ONTARIO, M2N 6A6
ATTN: A. KHAN
SR. ENVIRONMENTAL COORDINATOR

INDICATE IF ADDITIONAL WRITTEN COMMENTS ARE TO FOLLOW: YES

NO

✓

PLEASE HAND IN THE COMPLETED FORMS AT THE END OF THE SESSION. THANK YOU
FOR YOUR PARTICIPATION AND COOPERATION.

WINDERMERE BASIN REHABILITATION PROJECT
ENVIRONMENTAL ASSESSMENT & REVIEW PROCESS
PUBLIC INFORMATION SESSION

COMMENTS FORM

NAME: SARAH MILLER

ADDRESS:

243 QUEEN ST. W
4TH FLOOR
TORONTO, ONTARIO
M5V 1Z1

PHONE:

(416) 977-2410

H
B

REPRESENTING:

SELF:

GROUP/ORGANIZATION:

CANADIAN ENVIRONMENTAL
LAW ASSOCIATION
GREAT LAKES UNITED

COMMENTS:

WE HAVE LEARNED TODAY THAT
THERE ARE STILL MANY RELEVANT
STUDIES PENDING. THOSE ATTENDING
THIS MEETING RAISED A LOT OF
QUESTIONS WHICH WERE ANSWERED
BY REFERENCES TO OTHER DOCUMENTS
NOT CONTAINED IN THE INITIAL ASSESSMENT
DOCUMENT. & THERE IS A NEED TO
INCORPORATE THESE INTO THE ASSESSMENT
AS THE ~~EX~~ DOCUMENT IS NOT COMPLETE
WITHOUT THEM. THE ALTERNATIVES HAVE
NOT BEEN ADEQUATELY EXPLAINED
NOR HAS THE SEDIMENT QUALITY AND
ITS IMPACT ON FLORA AND FAUNA HAS NOT
BEEN INCLUDED. LONG-TERM MAINTENANCE
AND MONITORING PROGRAMS AND
JURISDICTIONAL RESPONSIBILITY ARE NOT →
OVER.

NOTE:

ADDITIONAL WRITTEN COMMENTS WILL BE ENTERTAINED UP TO 14 DAYS
AFTER THE INFORMATION SESSION.

SEND YOUR SUBMISSIONS TO:

PUBLIC WORKS CANADA

4900 YONGE STREET, 11TH FLOOR

WILLOWDALE, ONTARIO, M2N 6A6

ATTN: A. KHAN

SR. ENVIRONMENTAL COORDINATOR

INDICATE IF ADDITIONAL WRITTEN COMMENTS ARE TO FOLLOW: YES ☒

NO ☐

PLEASE HAND IN THE COMPLETED FORMS AT THE END OF THE SESSION. THANK YOU
FOR YOUR PARTICIPATION AND COOPERATION.

clear. IN VIEW OF THESE INADEQUACIES IN
THIS ASSESSMENT ~~THERE IS A NEED TO~~
AS WELL THERE IS NO DOCUMENTATION OF THE
COSTS OF OPTIONS WHICH LED TO THE SELECTION
OF THE PREFERRED OPTIONS.

THESE COMMISSIONS MEAN THIS INITIAL
DOCUMENT NEEDS REVISION & EXPANSION AND PUBLIC REVIEW
BEFORE IT IS FINALIZED.

THIS PROCESS AND THE WAY IT HAS BEEN
CARRIED OUT COMPROMISES THE REMEDIATION
PLANNING PROCESS. THERE HAS BEEN
- THE EFFORT TO DO AN ECOSYSTEM ANALYSIS
- THERE IS NO ~~RATE~~ BACKGROUND ON THE
- INFLUENCE OF THE BASIN ON THE HARBOUR
OR THE CHEMICALS OF CONCERN
- EXISTENCE OF CONTAMINATES IN THE WATER
COLUMN ~~IS~~ SHOULD NOT BE THE SOLE CRITERIA
- USED TO DETERMINE THE SEDIMENTS ARE NOT
HAZARDOUS. THERE NEEDS TO BE IN PLACE
- MUTANT STUDIES CARRIED OUT ON BIO-ASSAY
TESTING.

SARAH MILLER - P. 2

WINDERMERE BASIN REHABILITATION PROJECT
ENVIRONMENTAL ASSESSMENT & REVIEW PROCESS
PUBLIC INFORMATION SESSION

COMMENTS FORM

NAME: Dr C.K. Minns

ADDRESS: GREAT LAKES LABORATORY FOR FISHERIES
AND AQUATIC SCIENCES
BAYFIELD INSTITUTE
867 LAKESHORE ROAD, P.O. BOX 505
BURLINGTON, ONT L7R 4A6

PHONE: 634-9103
336-4874

H
B

REPRESENTING:

SELF:

GROUP/ORGANIZATION: DEPT. FISHERIES & OCEANS

COMMENTS:

We have provided an initial assessment, in
writing, and will likely forward further
written comments

NOTE: ADDITIONAL WRITTEN COMMENTS WILL BE ENTERTAINED UP TO 14 DAYS
AFTER THE INFORMATION SESSION.

SEND YOUR SUBMISSIONS TO: PUBLIC WORKS CANADA
4900 YONGE STREET, 11TH FLOOR
WILLOWDALE, ONTARIO, M2N 6A6
ATTN: A. KHAN
SR. ENVIRONMENTAL COORDINATOR

INDICATE IF ADDITIONAL WRITTEN COMMENTS ARE TO FOLLOW: YES ☒
NO ☐

PLEASE HAND IN THE COMPLETED FORMS AT THE END OF THE SESSION. THANK YOU
FOR YOUR PARTICIPATION AND COOPERATION.

WINDERMERE BASIN REHABILITATION PROJECT
ENVIRONMENTAL ASSESSMENT & REVIEW PROCESS
PUBLIC INFORMATION SESSION

REC'D by MAIL
880615

COMMENTS FORM

NAME: MARK SPROULE - JONES

ADDRESS:

POLITICAL SCIENCE DEPT
MCMASTER UNIVERSITY
HAMILTON, ONT
L8S 4M4

PHONE: 517-1499

H
B

REPRESENTING:

SELF: ☒

GROUP/ORGANIZATION: ☒

COMMENTS: (1) WHILE I AGREE THAT BROADER ISSUES OF
CONTAMINATED SEDIMENT INPUTS INTO THE
HARBOUR MUST BE ADDRESSED, I BELIEVE
THAT THIS PROJECT MUST PROCEED FOR
THE REASON THAT IT IS A VISIBLE
WAY IN WHICH THE HARBOUR CLEANUP CAN
REGISTER WITH THE GENERAL PUBLIC. MOST
POLLUTION IMPROVEMENTS IN THE HARBOUR ARE
AND WILL REMAIN LARGELY INVISIBLE AND
INCREMENTAL.

(2) THE STUDY SHOULD DRAW ATTENTION TO THE
FACT THAT THE NEW LAND FORMS CANNOT
BE USED FOR INDUSTRIAL PURPOSES - AT
LEAST FOR 10 YEARS - AND THAT THEY
MAY FOSTER WILDLIFE STOCKS IN THE AREA OF
THE HARBOUR. THIS LATTER POINT SHOULD BE SUBJECT
TO FURTHER STUDY.

NOTE: ADDITIONAL WRITTEN COMMENTS WILL BE ENTERTAINED UP TO 14 DAYS
AFTER THE INFORMATION SESSION.

SEND YOUR SUBMISSIONS TO: PUBLIC WORKS CANADA
4900 YONGE STREET, 11TH FLOOR
WILLOWDALE, ONTARIO, M2N 6A6
ATTN: A. KHAN
SR. ENVIRONMENTAL COORDINATOR

INDICATE IF ADDITIONAL WRITTEN COMMENTS ARE TO FOLLOW: YES

NO ☒

PLEASE HAND IN THE COMPLETED FORMS AT THE END OF THE SESSION. THANK YOU
FOR YOUR PARTICIPATION AND COOPERATION.

WINDERMERE BASIN REHABILITATION PROJECT
ENVIRONMENTAL ASSESSMENT & REVIEW PROCESS
PUBLIC INFORMATION SESSION

1-8-10-0-0

COMMENTS FORM

NAME: Dr. J.R. Vallentyne ADDRESS: GLFRB, Dept. Fisheries & Oceans
Bayfield Laboratory
P.O. Box 5050
BURLINGTON, Ontario L7R 4A6
PHONE: (416) 527-4068 H REPRESENTING: 4350 - HS/43-2
(416) 336-4586 B A Khan SELF: X plus
GROUP/ORGANIZATION: ETC - Great Lakes
Science Advisory Board

COMMENTS: I have examined the draft "Initial Assessment for the Partial
Dredging and Filling of Windermere Basin" and the leaching study
of the Wastewater Technology Centre. In my opinion the data are
inadequate to document that the effect of the dredging and
filling proposal actually will be to reduce the flow of contam-
inants out of the Windermere Basin. The leachate studies are
suggestive of what MIGHT happen under actual conditions, but
inadequate to show what actually would happen under operating
conditions. Intermediate scale field trials are needed;
otherwise the proposal will rest on tenuous and untested
assumptions.

J.R. Vallentyne

NOTE: ADDITIONAL WRITTEN COMMENTS WILL BE ENTERTAINED UP TO 14 DAYS
AFTER THE INFORMATION SESSION.

SEND YOUR SUBMISSIONS TO: PUBLIC WORKS CANADA
4900 YONGE STREET, 11TH FLOOR
WILLOWDALE, ONTARIO, M2N 6A6
ATTN: A. KHAN
SR. ENVIRONMENTAL COORDINATOR

INDICATE IF ADDITIONAL WRITTEN COMMENTS ARE TO FOLLOW: YES _____
NO X

PLEASE HAND IN THE COMPLETED FORMS AT THE END OF THE SESSION. THANK YOU
FOR YOUR PARTICIPATION AND COOPERATION.

WINDERMERE BASIN REMEDIATION PROJECT
ENVIRONMENTAL ASSESSMENT & REVIEW PROCESS
PUBLIC INFORMATION SESSION

COMMENTS FORM

NAME: CHUCK POTTER

ADDRESS: 416 KENNELL AVE E

P.M.C. HAMILTON ONT

L9A-179
JUN 25 88 005308

PHONE: 388 0768

H
B

REPRESENTING: 4350-H5/43-2
SELF: A. Khan

GROUP/ORGANIZATION: ENVIRONMENTAL HAZARDS
TEAM.

COMMENTS: WE HAVE BEEN MISLED TO BELIEVE THIS
WILL BE A CLEAN UP OF WINDERMERE BASIN.
IT IS BEING "SWEPT UNDER THE CARPET"
IT IS BEING BURIED NOT CLEANED UP
WE ARE CLEANING UP HAMILTON HARBOUR
BUT WE ARE BURYING WINDERMERE BASIN.
THIS IS NOT ACCEPTABLE
A PROPER CLEAN UP TO PREVENT FUTURE
CONTAMINATION IS AN ACCEPTABLE SOLUTION.

NOTE: ADDITIONAL WRITTEN COMMENTS WILL BE ENTERTAINED UP TO 14 DAYS
AFTER THE INFORMATION SESSION.

SEND YOUR SUBMISSIONS TO: PUBLIC WORKS CANADA
4900 YONGE STREET, 11TH FLOOR
WILLOWDALE, ONTARIO, M2N 6A6
ATTN: A. KHAN
SR. ENVIRONMENTAL COORDINATOR

INDICATE IF ADDITIONAL WRITTEN COMMENTS ARE TO FOLLOW: YES
NO

PLEASE HAND IN THE COMPLETED FORMS AT THE END OF THE SESSION. THANK YOU
FOR YOUR PARTICIPATION AND COOPERATION.

WINDERMERE BASIN REHABILITATION PROJECT
ENVIRONMENTAL ASSESSMENT & REVIEW PROCESS
PUBLIC INFORMATION SESSION

COMMENTS FORM

NAME:

Wendy Jones

ADDRESS:

142 Totten Ave

PHONE:

545-0997

H
B

REPRESENTING:

SELF:

GROUP/ORGANIZATION:

C.H.O.C. Inc.

COMMENTS:

End use of this project.
To enhance area for
public use for
Wildlife Habitat.
(Waterfowl staging area.)

(Industrial Useage)
as an end result!

NOTE:

ADDITIONAL WRITTEN COMMENTS WILL BE ENTERTAINED UP TO 14 DAYS
AFTER THE INFORMATION SESSION.

SEND YOUR SUBMISSIONS TO:

PUBLIC WORKS CANADA

4900 YONGE STREET, 11TH FLOOR

WILLOWDALE, ONTARIO, M2N 6A6

ATTN: A. KHAN

SR. ENVIRONMENTAL COORDINATOR

INDICATE IF ADDITIONAL WRITTEN COMMENTS ARE TO FOLLOW: YES

NO

☒

PLEASE HAND IN THE COMPLETED FORMS AT THE END OF THE SESSION. THANK YOU
FOR YOUR PARTICIPATION AND COOPERATION.

WINDERMERE BASIN REHABILITATION PROJECT
ENVIRONMENTAL ASSESSMENT & REVIEW PROCESS
PUBLIC INFORMATION SESSION

COMMENTS FORM

NAME: D.M. HEROLD

ADDRESS: 1142 BURLINGTON ST. E.

PHONE: 545-1121 H
EXT 328 B

REPRESENTING:
SELF:
GROUP/ORGANIZATION: PROCTER & GAMBLE INC.

COMMENTS: BASED ON THE PAGE 75-77 OPTION COMPARISON
IT WOULD APPEAR THAT THE TERTIARY
TREATMENT MARSH CONCEPT FOR AN ADDITIONAL
2.8 MM WOULD ~~BE~~ DEAL WITH FUTURE SEDIMENT
CONCERNS IN A BETTER WAY THAN THE OPTION
BEING PROPOSED.

IN ADDITION THIS "TERTIARY OPTION" INDICATES
THAT IT WILL IMPROVE OPPORTUNITY FOR
AQUATIC HABITAT. THIS IS A CONCERN OF
SOME MEMBERS OF THE SESSION.

ANOTHER ADVANTAGE OF THIS "TERTIARY OPTION"
IS THAT SINCE STORM SEWER/COMBINED SEWER
OVERFLOW WILL BE A "LONG TERM" CONCERN
FOR CONTROL VIA STP DURING MAJOR STORMS
THIS TERTIARY CONCEPT WILL ADD ADDITIONAL
SAFEGUARDS TO REDUCE CONTAMINANTS REACHING
THE BAY.

NOTE: IN ORDER TO UNDERSTAND HOW EFFECTIVE THE PROPOSAL
ADDITIONAL WRITTEN COMMENTS WILL BE ENTERTAINED UP TO 14 DAYS
AFTER THE INFORMATION SESSION. "TRAP" WILL PERFORM VS A
TERTIARY TREATMENT CONCEPT.
SEND YOUR SUBMISSIONS TO: PUBLIC WORKS CANADA
4900 YONGE STREET, 11TH FLOOR
WILLOWDALE, ONTARIO, M2N 6A6
ATTN: A. KHAN
SR. ENVIRONMENTAL COORDINATOR

INDICATE IF ADDITIONAL WRITTEN COMMENTS ARE TO FOLLOW: YES
NO ☒

PLEASE HAND IN THE COMPLETED FORMS AT THE END OF THE SESSION. THANK YOU
FOR YOUR PARTICIPATION AND COOPERATION.

WINDERMERE BASIN REHABILITATION PROJECT
ENVIRONMENTAL ASSESSMENT & REVIEW PROCESS
PUBLIC INFORMATION SESSION

COMMENTS FORM

NAME: Brenda Axon

ADDRESS:

P.O. Box 1097

Station B

Burlington, Ontario

L7P 3S9

PHONE:

(416) 336-1158

H

REPRESENTING:

B

SELF:

GROUP/ORGANIZATION:

Halten Region Cons Auth.

COMMENTS: written comments to follow

NOTE: ADDITIONAL WRITTEN COMMENTS WILL BE ENTERTAINED UP TO 14 DAYS
AFTER THE INFORMATION SESSION.

SEND YOUR SUBMISSIONS TO: PUBLIC WORKS CANADA
4900 YONGE STREET, 11TH FLOOR
WILLOWDALE, ONTARIO, M2N 6A6
ATTN: A. KHAN
SR. ENVIRONMENTAL COORDINATOR

INDICATE IF ADDITIONAL WRITTEN COMMENTS ARE TO FOLLOW: YES ☒
NO ☐

PLEASE HAND IN THE COMPLETED FORMS AT THE END OF THE SESSION. THANK YOU
FOR YOUR PARTICIPATION AND COOPERATION.

WINDERMERE BASIN REHABILITATION PROJECT
ENVIRONMENTAL ASSESSMENT & REVIEW PROCESS
PUBLIC INFORMATION SESSION

COMMENTS FORM

NAME: E.E. SMEE

ADDRESS:

368 PHILIP PL.
ANCASTER, ONT.
L9G 3G8

PHONE: 648 1402 H
NIL. B

REPRESENTING:

SELF: CONSERVER SOCIETY

GROUP/ORGANIZATION: OF HAM. & DIST. INC.

COMMENTS: I WILL SEND COMMENTS BY
MAIL AFTER CONSULTATION WITH MY
ORGANIZATION.

I VIEW THE PROPOSAL AS THE
BEST WITH AVAILABLE MONEY.
FURTHER, THE DESIGN ALLOWS FOR
FURTHER REFINEMENTS AS EXPERIENCE
REVALUATION IS CARRIED OUT IN
THE FUTURE.

NOTE: ADDITIONAL WRITTEN COMMENTS WILL BE ENTERTAINED UP TO 14 DAYS
AFTER THE INFORMATION SESSION.

SEND YOUR SUBMISSIONS TO: PUBLIC WORKS CANADA
4900 YONGE STREET, 11TH FLOOR
WILLOWDALE, ONTARIO, M2N 6A6
ATTN: A. KHAN
SR. ENVIRONMENTAL COORDINATOR

INDICATE IF ADDITIONAL WRITTEN COMMENTS ARE TO FOLLOW: YES ☒
NO ☐

PLEASE HAND IN THE COMPLETED FORMS AT THE END OF THE SESSION. THANK YOU
FOR YOUR PARTICIPATION AND COOPERATION.

Afternoon.

WINDERMERE BASIN REHABILITATION PROJECT
ENVIRONMENTAL ASSESSMENT & REVIEW PROCESS
PUBLIC INFORMATION SESSION

ATTENDEES LIST

<u>NAME</u>	<u>ADDRESS</u>	<u>PHONE NO.</u>
Burlington Engineering	2072 Golf Club Rd	692-3738
	RR#1 Hannon,	
John Lumbry	610 Locust St	
	Burlington	634. 2647.
	L7S1V8	
E. J. McInnis Scepter		549 8283
Macdonald	112 Lincoln St	529-9015

NOTE:

ADDITIONAL WRITTEN COMMENTS WILL BE ENTERTAINED UP TO 24 DAYS
AFTER THE INFORMATION SESSION.

SEND YOUR SUBMISSIONS TO:

PUBLIC WORKS-CANADA

4000 JONES STREET, 11TH FLOOR

WILLOWDALE, ONTARIO, M2H 6M1

ATTN: A. SIMS

OR ENVIRONMENTAL COORDINATOR

INDICATE IF ADDITIONAL WRITTEN COMMENTS ARE TO FOLLOW: YES ☐ NO ☐

PLEASE REMAIN IN THE DESIGNATED AREA AT THE END OF THE SESSION. THANK YOU
FOR YOUR PARTICIPATION AND CONTRIBUTIONS.

WINDERMERE BASIN REHABILITATION PROJECT
ENVIRONMENTAL ASSESSMENT & REVIEW PROCESS
PUBLIC INFORMATION SESSION

AFTERNOON.

COMMENTS FORM

NAME: DON HARRINGTON

ADDRESS:

RR#1 SMITHVILLE
ONTARIO

PHONE:

692-3738

H

REPRESENTING:

522-7033

B

SELF:

GROUP/ORGANIZATION: HARRINGTON ENGINEERING
LTD.

COMMENTS: - WE ARE DEFINITELY INTERESTED IN OBTAINING
A COPY OF YOUR DRAFT REPORT FOR
PERUSAL

- WE HAVE AN INTEREST IN RETAINING
SOME FORM OF WATER SUPPLY, OR AN
ALTERNATE SUPPLY, FOR OUR QUENCHING
OPERATION.

- WE ALSO UNDERSTAND THAT SOME FORM
OF TRANSPORTATION OF BEEM MATERIAL WILL
TAKE PLACE IN THE AREA OF OUR OPERATION,
SO ARE CONCERNED ABOUT ANY POSSIBLE
RAMIFICATIONS OF THIS ALSO.

NOTE:

ADDITIONAL WRITTEN COMMENTS WILL BE ENTERTAINED UP TO 14 DAYS
AFTER THE INFORMATION SESSION.

SEND YOUR SUBMISSIONS TO:

PUBLIC WORKS CANADA

4900 YONGE STREET, 11TH FLOOR

WILLOWDALE, ONTARIO, M2N 6A6

ATTN: A. KHAN

SR. ENVIRONMENTAL COORDINATOR

INDICATE IF ADDITIONAL WRITTEN COMMENTS ARE TO FOLLOW: YES

NO

 ?

PLEASE HAND IN THE COMPLETED FORMS AT THE END OF THE SESSION. THANK YOU
FOR YOUR PARTICIPATION AND COOPERATION.

WINDERMERE BASIN REHABILITATION PROJECT
ENVIRONMENTAL ASSESSMENT & REVIEW PROCESS
PUBLIC INFORMATION SESSION

ATTENDEES LIST

<u>NAME</u>	<u>ADDRESS</u>	<u>PHONE NO.</u>
N. A. SHYAL	704 MARLEY RD. BURLINGTON, ONT.	637-0345
Bob Young	CKOC	545-5222
Rob Dobas	1319 Book Rd. W. Jerseyville LORARO	648-0425
Paul Mulloon	225 Caroline St S	526 7361
Bruce Brown	The Spectator	526-3333
Les van Lemmerde	41 King William St	525-8538
Loretta Dais	662 Blower Rd Cr	876-2537
John D. ...	Region of Hamilton - West Hurontario	526-4300
Bishop	HAM. NATCUB	5218946
Adrian Van Kester	44 Everton Pl. Ham.	3835328
M. Murphy	CHCH TV	

WINDERMERE BASIN REHABILITATION PROJECT
ENVIRONMENTAL ASSESSMENT & REVIEW PROCESS
PUBLIC INFORMATION SESSION

Dec 88-06-24

COMMENTS FORM

MR. John A. SHYNAL

NAME:

ADDRESS:

704 MARLEY RD,
BURLINGTON, ONT.

L7T 3R9

PHONE: 637-0345

H
B

REPRESENTING:

SELF: ✓

GROUP/ORGANIZATION:

COMMENTS: MIGHT I SUGGEST, THAT AFTER THE
PLANNED DREDGING IS COMPLETED, A SERIES
OF HIGH-PRESSURE (SUBMURGED) WATER
FOUNTAIN SPOUTS BE INSTALLED IN THE
REMAINING CHANNEL. THESE FOUNTAIN
SPRAYS WOULD BE OPERATED 24 HOURS A
DAY, 365 DAYS PER YEAR AND (I BELIEVE)
WOULD ACCOMPLISH THE FOLLOWING.

- (1) - HELP TO OXYGENATE THE WATER IN THE
CANAL (CHANNEL).
- (2) - ASSIST IN (SOME) PURIFICATION OF THE WATER
BY PERMITTING AN INCREASED WATER/AIR/SUN
LIGHT INTERFACE, AND THEREFORE
(POSSIBLY) ASSISTING IN THE BREAK-DOWN
OF SOME OF THE IMPURITIES IN THE
WATER.
- (3) BY ALSO PLACING SPOTLIGHTS ON EACH

(CONTINUED OVERLEAF) →

NOTE:

ADDITIONAL WRITTEN COMMENTS WILL BE ENTERTAINED UP TO 14 DAYS
AFTER THE INFORMATION SESSION.

SEND YOUR SUBMISSIONS TO:

PUBLIC WORKS CANADA
4900 YONGE STREET, 11TH FLOOR
WILLOWDALE, ONTARIO, M2N 6A6
ATTN: A. KHAN
SR. ENVIRONMENTAL COORDINATOR

INDICATE IF ADDITIONAL WRITTEN COMMENTS ARE TO FOLLOW: YES
NO ✓

PLEASE HAND IN THE COMPLETED FORMS AT THE END OF THE SESSION. THANK YOU
FOR YOUR PARTICIPATION AND COOPERATION.

Cont. - OF THE WATER SPOUTS AT NIGHT
TIME, IT WOULD PRESENT AN
ATTRACTIVE SIGHT IN AN OTHERWISE
UNATTRACTIVE AREA.

THE LIGHTED FOUNTAIN SPRAYS ~~WOULD~~
~~BE~~ VIEWED BY THE MILLIONS OF
PEOPLE WHO TRAVEL THE QUEEN
ELIZABETH WAY, WOULD IN TIME
PRESENT A VISIBLE PICTURE OF AN
EFFORT INTO POLLUTION CONTROL IN
AN AREA THAT BADLY NEEDS IT.

THE SPRAYS WOULD IN A SMALL
WAY ALSO CAMOFLAGE THE
DROLL AREA (SLAG PILES) THAT EXIST
BEHIND THE WATER WAY

THE SINGLE PUMP-HOUSE REQUIRED
TO CREATE THE WATER PRESSURE
FOR ALL OF THE (IN TANDEM) FOUNTAIN
AINS WOULD BE A SMALL OUTLAY
FOR SUCH A POTENTIAL AESTHETIC
IMPROVEMENT.

THANK YOU

J. Syneel

EVENING

WINDERMERE BASIN REHABILITATION PROJECT
ENVIRONMENTAL ASSESSMENT & REVIEW PROCESS
PUBLIC INFORMATION SESSION

COMMENTS FORM

NAME:

Paul Mullooy

ADDRESS:

225 Caroline St S
Hamilton Ontario
L8N 3L5

PHONE:

526-7361
1-528 5856

H
B

REPRESENTING:

SELF: ☒

GROUP/ORGANIZATION:

Energy Probe
Great Lakes United

COMMENTS:

→ good presentation

→ responsive answers

(complete)
→ real concern if proper notice to
public given

→ of course, do not agree with
some responses

NOTE:

ADDITIONAL WRITTEN COMMENTS WILL BE ENTERTAINED UP TO 14 DAYS
AFTER THE INFORMATION SESSION.

SEND YOUR SUBMISSIONS TO:

PUBLIC WORKS CANADA
4900 YONGE STREET, 11TH FLOOR
WILLOWDALE, ONTARIO, M2N 6A6
ATTN: A. KHAN
SR. ENVIRONMENTAL COORDINATOR

INDICATE IF ADDITIONAL WRITTEN COMMENTS ARE TO FOLLOW:

YES I will try
NO

PLEASE HAND IN THE COMPLETED FORMS AT THE END OF THE SESSION. THANK YOU
FOR YOUR PARTICIPATION AND COOPERATION.

COMMENTS FORM

NAME: Lees van Gemerden ADDRESS: 41 KING William St #406
HAMILTON, ONT
L8R 1A2

PHONE: 525 8538 H B REPRESENTING: _____
SELF: ☒ GROUP/ORGANIZATION: _____

COMMENTS: I would like to comment on the rather poor
notice given for this important public meeting.
(I counted approx five people representing the general
public.) Perhaps location (Hlan. Y. Club), that
forced off private club, which states on its gate
"members and guests only", functioned as an
intimidating factor. May I suggest that an
independent, people oriented P.R. person/firm
will be hired to facilitate full public
participation in future public meetings!?
As for the meeting itself, I found it informative
in terms of presentation. However, the draft
summary report handout did not convince
me in any way that future discharges
of contaminants will not take place.
I feel that, unless steps are taken to

NOTE: ADDITIONAL WRITTEN COMMENTS WILL BE ENTERTAINED UP TO 14 DAYS
AFTER THE INFORMATION SESSION.

SEND YOUR SUBMISSIONS TO: PUBLIC WORKS CANADA
4900 YONGE STREET, 11TH FLOOR
WILLOWDALE, ONTARIO, M2N 6A6
ATTN: A. KHAN
SR. ENVIRONMENTAL COORDINATOR

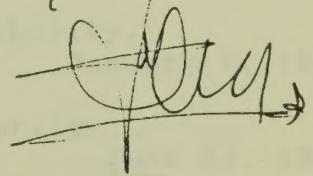
INDICATE IF ADDITIONAL WRITTEN COMMENTS ARE TO FOLLOW: YES _____
NO ☒

PLEASE HAND IN THE COMPLETED FORMS AT THE END OF THE SESSION. THANK YOU
FOR YOUR PARTICIPATION AND COOPERATION.

Cees Van Gemerden,
King William Street,
404, Hamilton, Ontario, Canada
L1A2
(416) 525-8538

restrict the flow of contaminants into the
basin & Ham. harbor → lake out → etc, that
windermere basin project, at best should be
considered an environmental band-aid project
providing a fat contract for a dredging company
and employment for a few workers (hopefully
made to wear masks and protective clothing)

Sincerely,



APPENDIX - B

CONTENTS:

Responses as part of the Environment/Regulatory Agency consultation program.

- 1 - Fisheries and Oceans Canada letter, June 9, 1988
- 2 - Fisheries and Oceans Canada position paper,
June 6, 1988
- 3 - Ontario Ministry of Natural Resources letter,
June 13, 1988
- 4 - Ontario Ministry of Natural Resources letter,
June 23, 1988
- 5 - Hamilton Naturalist Club recommendations,
June 16, 1988
- 6 - Region of Hamilton-Wentworth letter, June 21, 1988
- 7 - Hamilton Region Conservation Authority,
January 7, 1988
- 8 - Halton Region Conservation Authority,
June 23, 1988

Bayfield Institute
867 Lakeshore Road
P.O. Box 5050
Burlington, Ontario
L7R 4A6

Institut Bayfield
867, chemin Lakeshore
C.P. 5050
Burlington (Ontario)
L7R 4A6

Your file Votre référence

Our file Notre référence

0268C

9 June 1988

Huser Kahn,
Department of Public Works,
4900 Yonge Street,
WILLOWDALE, Ontario M2N 6A6

Dear Sir:

DFO Specific Fish/Fish Habitat Concerns
Re: Windermere Basin Rehabilitation Project

We have tried to organize our points chronologically to cover the present situation and after completion. We are assuming that further chemical source control will occur over time and that fisheries restoration will be a realistic option in the future. Our concerns with this project focus on the implications to fisheries restoration in other parts of the harbour. We are also anxious that steps taken now to address a serious contaminant situation do not preclude fisheries restoration in the future when contaminant loadings are reduced. As we have already stated, we use the DFO Fish Habitat Policy as a guide in our evaluation.

I. Present Situation:

Windermere Basin as it presently exists is not considered desirable fish habitat. Indeed, because of the morphometry of the Basin, there is little space or volume for fish to occupy. Because of exposure to contaminated sediments, water, and food, fish using the Basin would accumulate chemicals which could impair their health or present a risk to consumers, assuming that these fish move throughout the Harbour, and would affect the utility of all Harbour fish.

continued/2

However, several species of fish have been captured in Windermere Basin (carp, goldfish, and their hybrids, white suckers, brown bullheads, yellow perch, and sticklebacks). Their presence is due to the combined effects of increased temperature and nutrients, and the attraction of fish to fluvial habitats (even if they are as severely degraded as they are now in Windermere Basin).

II. After Completion Assuming Contaminant Sources Are Still Entering The Basin:

A) Habitat Creation and Contaminant Exposure

We expect that as a consequence of the Basin remodelling, adult fish will be attracted because of:

- a) The existing fluvial/'estuarine' nature of the Basin as a flow-through area for Redhill Creek, and other inputs, will be enhanced.
- b) The nutrient enriched status of the water will remain as will the elevated temperature due to the STP effluent.
- c) The deepening with/without the sediment retention baffles will provide new 'space' for fish.

In short, the project will create fish habitat where none exists now. Given this situation, we are concerned that more Harbour fish would be attracted to the Basin and accumulate contaminants counteracting gains in the Harbour arising from implementation of the RAP.

B) Effects of disposed contaminated spoils on fish habitat in other parts of the Harbour:

If the existing quantities of sediment and contaminants continue to enter the Basin, the sediment trap will fill up relatively quickly and the new sediments will be contaminated. We are concerned that other habitat areas in the Harbour would have to be filled to provide contained disposal sites for sediment newly dredged from the trap. Thus, in this scenario there is the possibility that the solution for the Basin will cause problems for the Harbour.

continued/3

III. After Completion Assuming That Contaminants Are No Longer Entering The Basin:

If the quantities of sediment and contaminants entering the Basin are greatly reduced as a result of RAP implementation, this outcome would only serve to further enhance the suitability of the Basin as fish habitat. In this situation, we cannot ignore the fact that the Basin is part of a stream entering the Harbour. Such habitat is in limited supply in the Harbour. In this case, it would be highly desirable to add features to the proposed project which would facilitate future use of the Basin for spawning and nursery activities by fish, and to avoid uses of the adjacent land which would negatively impact on the fish's use of the habitat. For the former, selective gentle-sloping of the berms on the Basin side in conjunction with the sediment retention baffles or peninsula-like additions to the berms, would, once vegetated, provide suitable habitat for warmwater species such as bass. For the latter, natural vegetation would ensure that the riparian areas were relatively undisturbed.

IV. Conclusion And Recommendations:

Thus given that the Basin project is intended to complement actions under the Harbour RAP, we recommend that the project plan recognize that deepening Windermere Basin will create some fish habitat, and that with certain modifications to the steeply-sloped berms would create future fish habitat which will be a desirable addition to the supply in the Harbour as a whole. To this end we recommend:

- a) Assess the alternative sediment/contaminants scenarios and devise changes which will not preclude future options.
- b) We recommend that gentle-sloping of the berms be included in the project to complement the baffles if used, or with added peninsulas otherwise, to add suitable nursery and spawning habitat to the adult habitat which will be created by the present project.

continued/4

page 4

Huser Kahn

June 9, 1988

In addition, we noted that the project does not specifically include any assessment of flora and fauna although they are mentioned in the rationale. Given our concerns, we recommend:

that the use of the new Basin by fish, adult and young, be assessed in each of three seasons, spring, summer, and fall, in the 3 years immediately following the completion of the project, and that this work be undertaken as part of the project.

Yours sincerely,

Dr. J.M. Cooley,
Director,
Physical & Chemical Sciences Branch

cc: Simon Llewellyn, Manager,
Program Coordination,
EPS Central Region,
25 St. Clair Avenue, East,
Toronto, Ontario M4T 1M2

Harvey Shee

Dr. Harvey Shear,
Area Manager,
Fisheries & Habitat Management

Bob Edwards
Hamilton Harbour Commission

Bayfield Institute
867 Lakeshore Road
P.O. Box 5050
Burlington, Ontario
L7R 4A6

Institut Bayfield
867, chemin Lakeshore
C.P. 5050
Burlington (Ontario)
L7R 4A6

Your file Votre référence

Our file Notre référence

June 6, 1988

DFO Stakeholder Initial Assessment:
Proposed Windermere Basin Rehabilitation Project

We have examined this material from the perspective of the DFO Fish Habitat Policy. The policy argues strongly for a NET GAIN of fish habitat wherever ecosystem changes are proposed. Three main actions are considered: Conservation (set aside that habitat which is undisturbed and productive), Restoration (eliminate past changes and damage to recreate productive habitat), and Enhancement (use measures to increase the productivity of existing habitat). In Hamilton Harbour and Windermere Basin, we are largely concerned with restoration although we recognize because some habitats are irretrievably lost, enhancement must also be considered. The Windermere Basin plan deals exclusively with the Basin and fails to explore the long-term implications to the Stakeholder's eight goals for the Harbour. The proposed actions will affect fisheries, wildlife, land use, and aesthetics, and should address each of these topics. Throughout the RAP process, the stakeholders have stressed the 'Ecosystem Approach'. You cannot manage a total resource by dealing with projects individually. Our major concerns with the proposal are focussed on the apparent lack of integration with long-term goals for Hamilton Harbour. Below we have outlined a number of points relevant to the evaluation of the draft proposal:

- 1) Naturally, we would have preferred that the fish habitat in the Windermere Basin had never been degraded from its initial condition. We accept that it is not possible to turn the clock back completely. However, we believe that the proposed plan for Windermere basin may adversely affect fisheries restoration in other parts of the Harbour. We would prefer to consider actions now that will not preclude future restoration of fish habitat. We would rather have seen a proposal which encompasses the total problem i.e. which includes sediment control in the Redhill Creek watershed, the proposed use(s) of any land created by filling-in Windermere Basin, future sites for sediment disposal, the main basin of Hamilton Harbour, etc. Instead, we are only asked to comment on a proposal to modify the Windermere Basin itself. These artificially narrow boundaries to the problem set severe constraints and are incompatible with the ecosystem approach.

continued/2

DFO Stakeholder Initial Assessment:
Proposed Windermere Basin Rehabilitation Project

2) Given that we are restricted to considering the partial dredge and fill option, we will raise a number of fisheries concerns specific to that:

- The question of how the sediment load to the Basin might be reduced thereby minimizing the future disposal of dredge spoils, is not included in the project and yet is clearly critical to its 'success'. Specifically, what will be done with sediments dredged from the 'new' Basin?
- Are the contaminant inputs to be severely reduced? If so, then, apart from the in-place contaminants, there would be no need to retain sediment in the Basin in the future as it would not constitute a threat to the Harbour. The in-place contaminants could be removed and disposed of either at a disposal facility or by incineration. If contaminant inputs remain high, the Basin will continue to represent a threat in itself and to the Harbour as a source of contaminants. Clearly if the contaminant sources are to be eliminated, a different suite of options are presented including the creation of some valuable marsh habitat.
- The sediment retention capacity is estimated to have a lifetime of 7 to 12 years. At that time, will we be confronted with a further proposal to complete the filling-in of the Basin or will there be a further need for sediment disposal. Assuming the sediment will be contaminated and the HHC confined disposal facility will be almost full by that time, where would this new accumulation of sediment be placed? Will there be a need for another disposal facility within the Harbour? If the sediment were 'clean', it could be released in the lake.
- Why is the wildlife habitat development not included in the project? We understood at the time that the Windermere project was separated from the Hamilton Harbour RAP, that wildlife accommodations would be included in any proposal. The draft makes it clear that nothing would be done until well after the completion of the reconstruction and that the project funds would not cover the habitat development. Indeed, the preferred option would appear to preclude any accommodation of wildlife.

continued/3

Page 3
June 6, 1988

DFO Stakeholder Initial Assessment:
Proposed Windermere Basin Rehabilitation Project

- While the proposed changes will do nothing to contribute to the expansion of the supply of nursery and spawning habitat for fish in Hamilton Harbour, the area will become more attractive to adult fish because of the creation of deeper areas and elevated temperatures. Given that contamination will still be a problem, the presence of more fish will enhance the transfer and accumulation of contaminants into Harbour fish.
- 3) As aesthetics is a major concern in the Basin, we suggest that marsh habitat be considered as a viable alternative to other unrevealed land-uses. Aesthetics are subjective and many might view industrial sites in the same manner as the present Basin.
- 4) Overall we find it hard to see the proposed changes as 'rehabilitation' since they are designed to hide symptoms and fail to include the ultimate causes of the problem. Such an approach is inconsistent with the ecosystem view espoused by the IJC and the Hamilton Harbour RAP. We recommend that the project include:
 - i) A strategy for reducing sediment inputs to the basin and a scenario for decreasing the need for dredging
 - ii) A plan for the treatment and disposal of sediments from the newly-created settling basin
 - iii) Chemical characterization of sediments/waste entering Windermere and estimates of the future quality of the Basin's sediments
 - iv) A clear indication of land use for the newly-created areas along the Windermere Basin.

C.K. Minns

DFO Stakeholder Representative
Dr. C.K. Minns, Systems Ecologist



Ontario

Ministry of Ministère des
Natural Richesses
Resources naturelles

P.O. Box 2186
605 Beaverdale Rd.
CAMBRIDGE, Ontario
N3C 2W1

June 13, 1988

Public Works Canada
4900 Yonge Street
11th Floor,
WILLOWDALE, Ontario
M2N 6A6

ATTENTION: A. KHAN
SR. ENVIRONMENTAL CO-ORDINATOR

SUBJECT: Windemere Basin Rehabilitation Project
Environment Assessment and Review Process

As a follow-up to our recent stakeholders meeting concerning comments to the "Draft Initial Assessment" for the partial dredging and filling of Windemere Basin, the Ministry of Natural Resources has one major concern with the proposal from a fish and wildlife habitat rehabilitation and enhancement standpoint.

We are in complete agreement with the removal of contaminated sediment from the basin and the beneficial effects this work will have on the harbour as a whole. This agreement was conveyed in a recent letter to K.E. Brant of Transport Canada through an application to approve the work under the N.W.P.A.

In light of the objectives and goals of the Remedial Action Plan for Hamilton Harbour of which our Ministry is a Stakeholder, the draft plan does not address the:

- 1) elimination of existing wildlife habitat
- 2) a land use strategy for the disposal site after construction
- 3) enhancement of fish and wildlife habitat within the basin
- 4) provision of sufficient buffering of sediment loading from Redhill Creek and the S.T.P. during the construction phase through the reroute of the basin

Ministry representatives would like to meet with your department in the near future to discuss these concerns before a final plan is prepared.

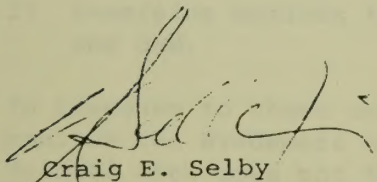
Perhaps some points to consider before our meeting would be:

- 1) varying the slope of the berm lining the basin along its length to create the "edge effect" needed to enhance fish and wildlife habitat
- 2) depositing top soil along the rip rap installation increasing the potential production of vegetation for habitat purposes
- 3) develop a land use strategy for the disposal sites which would incorporate the creation of a green belt for further enhancement of wildlife habitat and add to the aesthetics of the area
- 4) ensure sufficient buffering of sediment loading from Redhill Creek and the S.T.P. along the reroute of the basin during the construction phase. Is it possible to construct additional weirs along the reroute or consider sufficient depth and width to the reroute to contain sediment before emptying into Hamilton Harbour?

It is interesting to note one of the comments at the meeting suggests pursuing rehabilitation of the area for fish and wildlife after the construction is completed. Would it not be more cost effective and timely to incorporate these concerns into the plan prior to implementation. This effort would fall in line with our present "ecosystem approach" to rehabilitating the harbour.

Peter Meerveld is the new representative for our Ministry and can be contacted at this office. We look forward to meeting with you to address our concerns.

Yours truly,



Craig E. Selby
Fish & Wildlife Supervisor
Cambridge District Office

658-9355 (519)

PM/slc

cc: Vic Cairns - Fisheries and Oceans Canada
Keith Rogers - Environment Canada
R.A. Edwards - Hamilton Harbour Commission
Mike Belcher - Ministry of Natural Resources
Len Simser - Royal Botanical Gardens
Glen Pearce - Envirosearch Limited



Ontario

Ministry of Natural Resources / Ministère des Richesses naturelles

P.O. Box 2186
605 Beaverdale Rd.
CAMBRIDGE, Ontario
N3C 2W1

June 23, 1988

Public Works Canada
4900 Yonge St.
11th Floor
WILLOWDALE, Ontario
M2N 6A6

ATTENTION: A. KHAN
SR. ENVIRONMENTAL CO-ORDINATOR

SUBJECT: Windemere Basin Rehabilitation Project
Environment Assessment and Review Process

Thank-you for your meeting of June 17, 1988 with my staff to discuss the Windemere Basin Project. The meeting gave us the opportunity to more fully understand the proposal and we offer the following comments.

Our main concerns are:

- 1) Degradation of water quality in the Main Hamilton Harbour basin during the dredging operation.
- 2) Creation of shoreline habitat along the berm for fish and wildlife purposes.
- 3) Examining options for future land use in the area between the basin and QEW.

In response to these concerns we would recommend the proponent monitor the Windemere outlet to ensure sediment load out of the dredged area does not threaten fish or dramatically increase contamination of the main harbour. Contingency plans should be in place if loading should become excessive.

Secondly, the concern over "hard engineering" the whole permiter berm with rip rap has been explained and I understand this is not to be the case except for the upper Redhill Creek section. We assume from discussions at this point the remaining berm section will settle, softening the shoreline in terms of slope and edge effect creating habitat for future fish and wildlife enhancement. Further

Mr. A. Khan

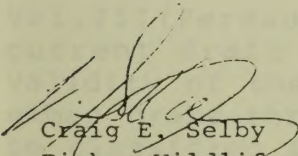
Page 2

consideration should be given to maximizing irregularities along the shoreline during the construction phase and reinforcing only in needed areas. The shoreline should be allowed to revegetate augmented by wildlife plantings on the banks and aquatic weeds in the shallow silty areas. If an island(s) should develop in the basin after construction consideration should be given for it be left to allow for further wildlife and fisheries habitat potential.

Although land use of the fill site is not within the mandate of the Windemere Basin Proposal, we would recommend the Hamilton Harbour Commission consult with R.A.P. agencies as to the potential to develop the site as a diverse wildlife habitat area and to increase the aesthetics of the harbour. This would be in keeping with the objectives as set out by R.A.P.

Please feel free to call Peter Meerveld at this office if clarification of our concerns are required.

Yours truly,



Craig E. Selby
Fish & Wildlife Supervisor
Cambridge District Office

658-9355 (519)

PM/slc

cc: Mr. Keith Rogers - Hamilton Harbour Remedial Action Plan
Mr. Glen A. Pearce - Envirosearch Limited
Mr. R.A. Edwards - Hamilton Harbour Commissioners
Mr. Ted Harvey - Ministry of Natural Resources
Mr. Mike Belcher - Ministry of Natural Resources
Regional Director - Central Region
Harvey Shear - Department of Fisheries & Oceans
Mr. Vic Cairns - Department of Fisheries & Oceans

WINDERMERE BASIN PROPOSAL-HAMILTON NATURALISTS' CLUB RECOMMENDATIONS

The most recent draft of the Windermere Basin Dredging Proposals produced by Envirosearch has improved the sections concerning biotic content and significance of Windermere Basin as a wildlife habitat but still falls short of an accurate representation of the Basin's biological status.

Indeed, throughout this report the authors continually suggest that Windermere will still be unfit as a habitat despite dredging operations-if this is the case then shouldn't the project be overhauled to ensure that it will be fit for waterfowl and other wildlife? The following examples of text highlight parts of the draft which express this perception of Windermere and which the HNC feels should be re-written.

"Although sediment provided a suitable substrate, it was devoid of organisms"-MOE report on In Place Pollutants Program Vol.III(Persaud et al. 1987) -This statement is quoted in the current draft however the author's failed to scrutinize the validity of the sample size in the MOE report, which was only 5 ekman grabs-three of which contained invertebrates and could not be classified as "devoid of organisms", and chose to report the conclusions made by Persaud which are clearly contradictory to recent samples taken by CWS and DFO. The HNC suggests that the more recent, and accurate data findings of invertebrate population densities of approx. 400 000 organisms/m should be given more consideration in the future reports.

In reference to the aesthetics of Windermere(p.37) the mudflats are further referred as being "sterile". In fact these mudflats which contain a high density of invertebrates attract a wide variety and high densities of shorebirds which use this area as a staging ground during migration. Windermere attracts a large number of birders from throughout Ontario due to the occurrence of provincially or regionally rare shorebirds that often arrive there in the fall. The HNC's position is that it is not the mudflats which are an eyesore but it is the garbage i.e.old tires, tricycles, driftwood which no government authority sees fit to removed during low water episodes.

The current draft states that pathogens in the sewage effluent from the Hamilton STP will threaten waterfowl in the Basin in the future. We challenge that statement for two reasons:
1)there is no data showing that avian pathogens are present in the sewage effluent
2)and according to the MOE's current reports the bacterial levels in the effluent are acceptable and will be even lower when the MISA program is established.

There is no question that waterfowl have been exposed to contaminants and were experiencing health problems as a result of exposure in Windermere. However, the current report states that birds were infected with Botulism in Windermere in the winter 1988. This is a fact but more birds were diagnosed with Botulism in the Harbour than in Windermere and it was concluded that the Botulism was not unique to Windermere and is in fact a natural occurrence in wetlands which are also non-contaminated.

Our club and CWS have forwarded a list of bird species which utilize Windermere and an estimate of the number of Mallard and Gadwall broods produced within Windermere in the summer 1987. None of this data has been incorporated in the current biological discussions on WB in the current report. We feel this information should be included since it demonstrates clearly the significance of the site and the fact that within a small area of cattail and sedge marsh remaining in the Basin it still manages to support breeding birds, larval fish such as five-spined stickleback, emerald shiner and pumpkinseed (Cairns, unpublished), snapping and painted turtles.

It is the HNC's understanding that the WB Tech. Adv. Comm. agreed to provide an area of 30m of littoral zone in the design of Windermere however this agreement does not appear to be incorporated in this new proposal. Furthermore the recent report suggests that the onus is on wildlife interest groups to provide the funding for these berms which the technical advisory committee had previously agreed to incorporate. The HNC feels that non-government groups should not be expected to pay for the rehabilitation of a marsh system which had historically existed in that area nor has this issue previously been presented to our club by the advisory committee. We feel that the statement of intention should be made in the report which essentially agrees that: the preferred final use of Windermere Basin is to be a wildlife habitat and "green space" and that this option should be pursued to its completion as a part of the overall rehabilitation of Windermere to its historical condition. Specifically it should be stated in the final proposal that "a 30m wide littoral zone which is designed to enhance the wildlife habitat in Windermere will be built when it has been shown that the containment berms are not allowing leakage of contaminants".

The current position of this assessment is that since it is not the mandate of the WB Tech. Advisory Committee to decide on the future uses of Windermere. The Advisory Committee's mandate is to ensure that the basin will be cleaned up in the most economical and efficient manner possible without provision for future uses at the present time. The HNC strongly urges the City, Provincial and Federal Governments to make a commitment now to the desired uses of Windermere in the future. This seems sensible and fundamental to us so that it might be possible to make some provisions for that future use during the dredging operations; incorporating such features as land design, which will be less costly to incorporate now rather than return and attempt to re-

design in the future. We also suggest, it will be politically difficult to initiate much change in the site once it is dredged due to the high costs involved.

We would like to have a committee established or the mandate of the WBTech.Adv. committee be extended to decide on the future uses for the Basin and for their decisions be reviewed by a public forum before the dredging begins.

We are almost being forced to conclude that there is little recognition by the authors of this report that Windermere is a significant area worthy of the government's time or money.

The current Federal Water Policy itself states that:

"the fed. government will contribute in the enhancement and conservation of Canada's wetlands" and do so by "reviewing and seeking to minimize the negative impact of federal policies, programs and activities" and it will encourage "land use practices, integrated land and water resource planning and practices to mitigate undesirable effects on existing wetlands".

Our club suggests that if the federal government is contributing \$1.2 million to this project that they should insist that some of this money be earmarked for wetland re-construction in Windermere to uphold the statements made in their own Federal Water Policy.

Our club has been very concerned about the health and diversity of wildlife in the Harbour, or lack thereof, we would not be supporting the development of WB as a future wildlife habitat unless it we did not feel it was a very important site worth preserving and developing as a green space and wildlife habitat.

We ask: why is it so difficult to convince the agencies involved that increasing the loss of wetland in the Harbour past the current 75% is foolish, especially when WB truly deserves preservation and rehabilitation?



THE REGIONAL MUNICIPALITY OF HAMILTON-WENTWORTH

Department of Engineering
71 Main Street West, Hamilton, Ont. L8N 3T4 (416) 526-4170

ID#0068D(68)

June 21, 1988

Refer to File No. 823-55
Attention of K. A. Brenner

Your File THE HAMILTON
HARBOUR COMMISSIONERS
RECEIVED

JUN 28 1988

FILE No. _____

LTR. No. 164

The Hamilton Harbour Commission
605 James Street North
Hamilton, Ontario
L8L 1J9

Att: Mr. R. A. Edwards, P. Eng.

Envirosearch - Draft Proposal on the
Dredging of the Windermere Basin

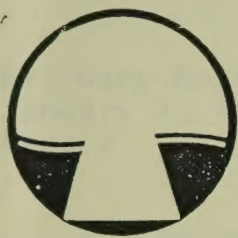
Gentlemen:

In reply to your letter of May 30 concerning the above, please be advised that we only can comment on the draft document. This is that there is not sufficient agricultural lands left in the drainage basin for the Ontario Ministry of Agriculture and Food to have any chance of reducing erosion. Reference to this Ministry is made on page 156.

S. Spencer
Commissioner of Engineering

KB:sm

HAMILTON REGION CONSERVATION AUTHORITY



P.O. BOX 7099 - MINERAL SPRINGS ROAD
ANCASTER, ONTARIO L9G 3L3
Phone 525-2181 or 648-4427

Ham. Harb.

File No.

January 7, 1988

RECEIVED

JAN 11 1988

Mr. Gary McFarlane, D.H.E., P. Eng.
President
Mar-Land Engineering Limited
21 Amber Street
Unit 8
Markham, Ontario
L3R 4Z3

MAR-LAND ENGINEERING
LIMITED

Dear Mr. McFarlane:

RE: Windemere Basin Study

When we met some time ago, I promised to send you my comments on the study you are now working on. It has taken sometime but here they are.

In general, my thoughts and ideas are in line with the recommendations of the Windemere Basin Technical Committee, which I chaired. I am sure I gave you a copy but if not, please give me a call. The following are some additional points.

1. Hamilton Harbour is an important natural resource and as a general philosophy, it is short sighted and regressive to eliminate portions of this resource by filling. If filling is inevitable, as seems to be the case with the basin, then every reasonable effort should be made to minimize the fill area and use the fill for the overall environmental benefit of the harbour and its surroundings. In this connection, I feel that the location and design of the containment cells should solely be determined by environmental factors. The following factors come to mind:

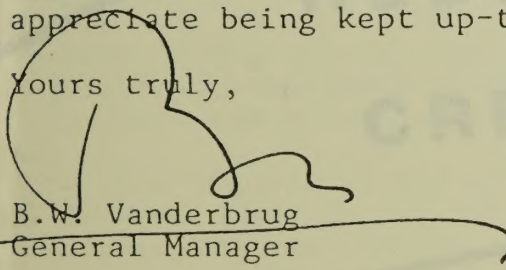
- The newly shaped shoreline should promote the settlement of new sediment in an area where periodic dredging and sediment removal is feasible.

Mr. Gary McFarlane, D.H.E., P. Eng.
January 7, 1988
Page 2

- The reshaped basin should reduce the potential of contaminated sediment from ending up in Hamilton Harbour by scouring action.
 - The new shoreline configuration and shoreline slope should be conducive to fish and wildlife habitat (see comments made by Hamilton Naturalists Club which I gave to you).
2. This project offers the once in a life time opportunity to improve the overall aesthetics of the basin. In this connection, I suggest that the dredged sediment be placed along the basin's east and south shoreline (see sketch). A landscape architect would have to be hired to determine the most effective height, width and location of the berms and the most suitable planting materials to use. As a general comment, I suggest that the berms not be looked at as a way of hiding inland development but rather to place these developments in a more attraction perspective. The other benefit of building berms is that they will reduce the size of the containment cells.
3. Red Hill Creek outlets into the basin. It is important that the hydraulic characteristics of this outlet be maintained or improved. A change in characteristics could conceivably cause flooding upstream during high flow events.

I trust that the above comments are of help to you and I would appreciate being kept up-to-date on study progress.

Yours truly,


B.W. Vanderbrug
General Manager

BWV:nb
Enc. - map

cc: Mr. Bob Hennessy (Enc.)

Lake Ontario

WINDERMERE
BASIN

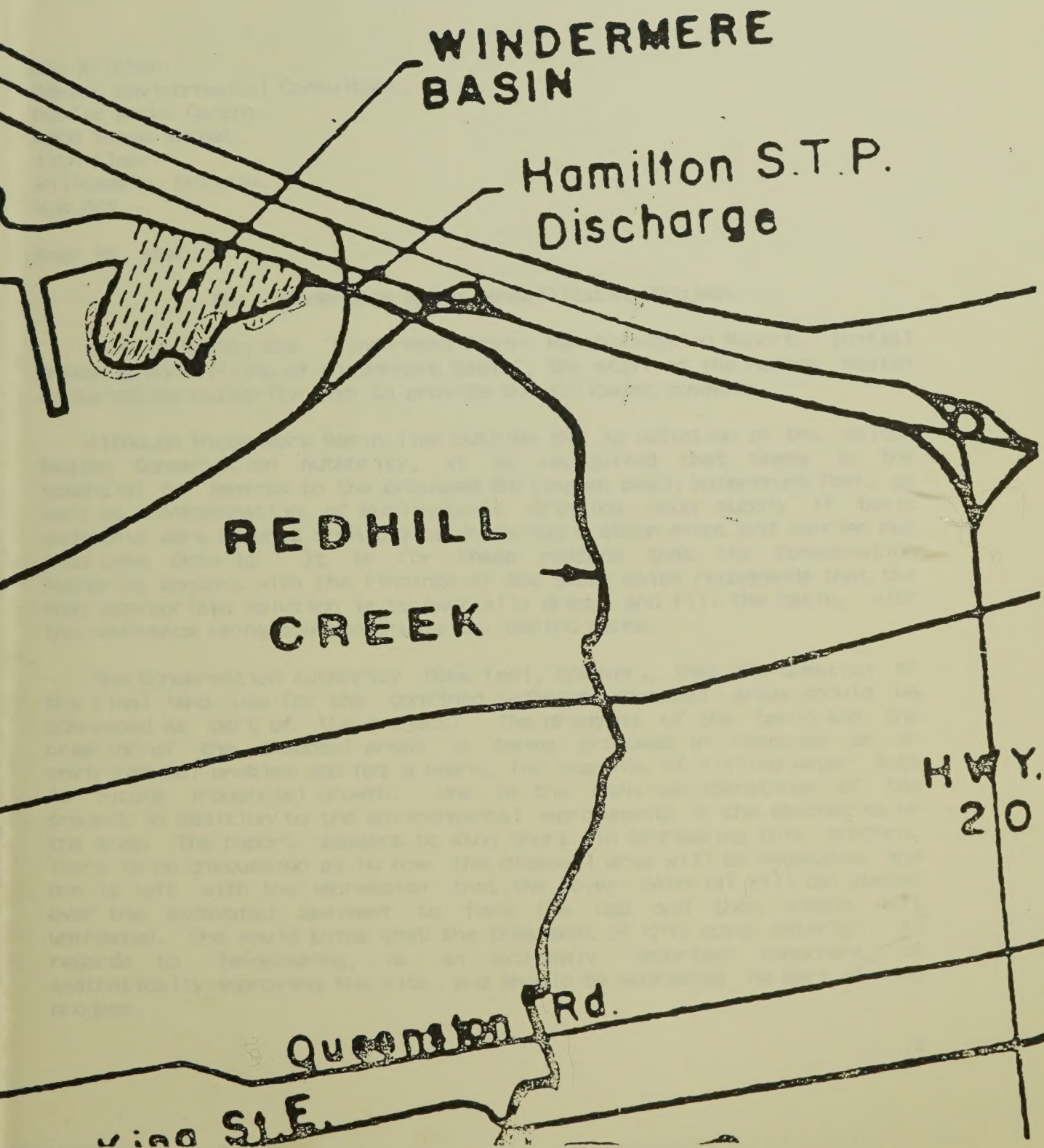
Hamilton S.T.P.
Discharge

REDHILL
CREEK

HWY.
20

Queenston Rd.

Wind S.E.





HALTON REGION CONSERVATION AUTHORITY

P.O. Box 1007, Station B - 2796 Fiddlers' Creek Road, West
Burlington, Ontario L7P 2P9

June 23, 1988.

Mr. A. Khan,
Senior Environmental Consultant,
Public Works Canada,
4900 Yonge Street,
11th Floor,
Willowdale, Ontario.
M2N 6A6

Dear Mr. Khan:

Re: Windermere Basin Rehabilitation Project

Upon reviewing the "Windermere Basin Rehabilitation Report, Initial Dredging and Filling of Windermere Basin", the staff of the Halton Region Conservation Authority wish to provide the following comments.

Although Windermere Basin lies outside the jurisdiction of the Halton Region Conservation Authority, it is recognized that there is the potential for impacts to the proposed Burlington Beach Waterfront Park, as well as contamination of Burlington's drinking water supply if toxic sediments were scoured from the basin during a storm event and carried out into Lake Ontario. It is for these reasons that the Conservation Authority concurs with the findings of the study which recommends that the most appropriate solution is to partially dredge and fill the basin, with the sediments being contained on-site, behind berms.

The Conservation Authority does feel, however, that the question of the final land use for the confined sediments disposal areas should be addressed as part of the project. The dredging of the basin and the creation of the disposal areas is being proposed in response to an environmental problem and not a means, for example, of filling water lots for future industrial growth. One of the main considerations of the project in addition to the environmental improvements is the aesthetics of the area. The report appears to stop short in addressing this concern. There is no discussion as to how the disposal area will be vegetated and one is left with the impression that the cover material will be pushed over the excavated sediment to form the cap and then simply left untreated. One would think that the treatment of this cover material, in regards to landscaping, is an extremely important component of aesthetically improving the site and should be addressed as part of the project.

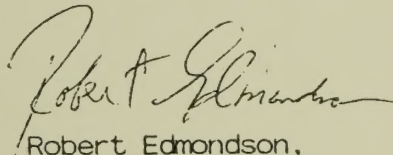
...../2

The report indicates that providing for waterfowl habitat may not be realistic at this time, however, it certainly could be viewed as a goal to be attained in the final rehabilitation of the site.

Finally, the project is viewed as very important and necessary and yet it should also provide an opportunity to enhance both the aesthetic and ecological attributes of the basin and in turn, the harbour as a whole.

The Halton Region Conservation Authority wishes to thank you for the opportunity to review and comment on the Windermere Basin Rehabilitation Project.

Yours truly,



Robert Edmondson,
Assistant General Manager.

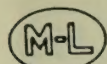
RE/lmo

c.c. Mr. Bob Edwards,
Hamilton Harbour Commission,
605 James St. N.,
Hamilton, Ontario. L8L 1K1

APPENDIX - C

CONTENTS:

Documentation of cost estimates for creating wildlife habitat modifications to Windermere Basin subsequent to completing the rehabilitation dredging project.

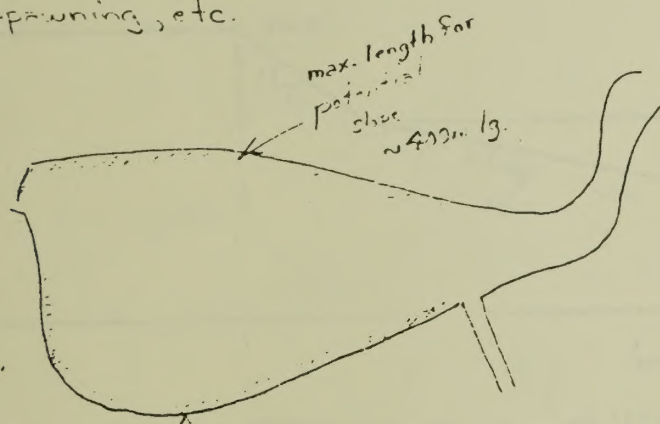


PROJECT 490-200
DETAILS Wiertermere Basin
Slope estimates.

SHEET 1
DATE June 22/88
BY GM
CHECKED BY _____

June 16/88 rings @ CCIW (DFO, CWS)

Estuarine nature of basin — develop gentle slopes along 'quiet' zones of Basin for fish spawning, etc.

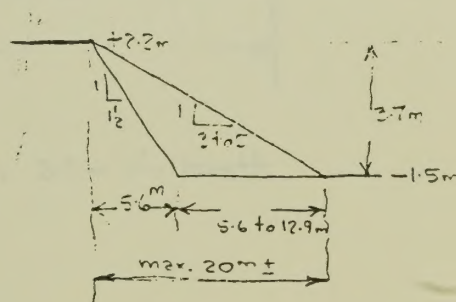


max. length ~400m lg.

Extra in say slope with 20m base



1:5 slope



$$\frac{1}{2} \times 20 \times 4 - \frac{1}{2} \times 6 \times 4 = 40 - 12 = 28 \text{ m}^3/\text{m length}$$

$$\text{Total extra side slope vol} \sim 1300 \text{ m} \times 28 \text{ m}^3 \approx 36,400 \text{ m}^3$$

Decrease in water vol. @ L.W. = 74.1m

$$\frac{36,400}{526,000} \times 100\% = 6.9\%$$

" " " " @ H.W. 74.9m

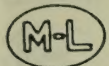
$$\frac{36,400}{624,000} \times 100\% = 5.7\%$$

} Say
6 to 7%
reduction
in basin
water vol.

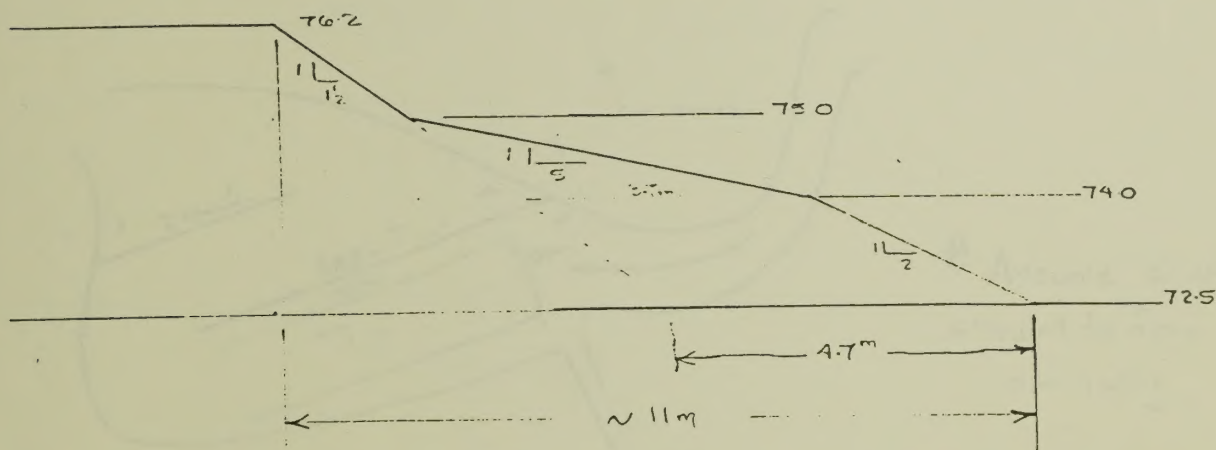
Cost to dump & shape

$$\text{est } 36,400 \text{ m}^3 @ 7.22/\text{m}^3 = 254,800$$

Say 250,000



b) - as in 'a' above but limited slope only for wildlife



Extra slope material $\approx \frac{1}{2} \times 3.7 \times 10 + \frac{3.7+4.7}{2} \times 15 = 8.2 \text{ m}^3/\text{m length}$

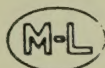
Say $10 \text{ m}^3/\text{m length}$

Total extra side slope vol $\approx 1300 \text{ m} \times 10 \text{ m}^3/\text{m} = 13,000 \text{ m}^3$

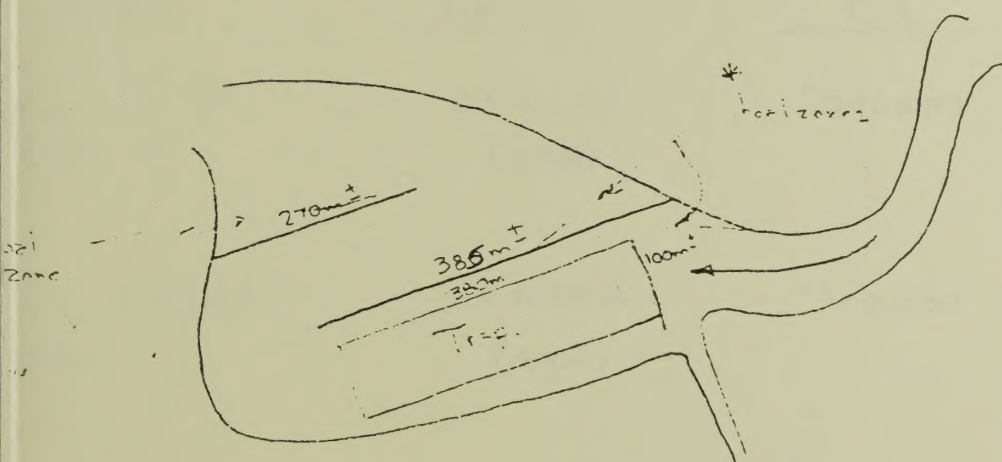
Reduction in basin water vol. $\approx 2.5\% \rightarrow 2.0\%$

Cost $\approx 13,000 \text{ m}^3 \times 7.00/\text{m}^3 = 91,000 + \text{trimming}$

Say \$100,000



(c) Spur Dyke Development - estimate based on Dyke #3 Model Test Scheme.

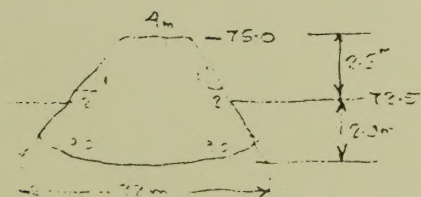


* Assume shoal zones allowed to form naturally.

Trap Vol. for 2.5m deep: $100 \times 330 \times 2.5 = 95,000 \text{ m}^3$

Say $100,000 \text{ m}^3$ with side slopes

Savings $\approx 10,000 \text{ m}^3 @ 4.60 = 46,000$



$$\text{Vol} \approx \frac{40+22}{2} \times 4.5 \approx 58.5 \text{ m}^3/\text{m lgh.}$$

$$\text{Total Dyke vol} \approx 270\text{m} + 385\text{m} = 655\text{m} @ 58.5 \text{ m}^3/\text{m} \\ \approx 38,300 \text{ m}^3$$

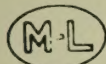
$$\text{Cost } 38,200 \text{ m}^3 @ 10.00/\text{m}^3 = 382,000$$

$$\text{Dredging savings} = 46,000$$

$$\text{Net extra cost} \approx 337,000$$

$$\text{Reduction in basin water vol.} \approx 15,000 \text{ m}^3 + 13,000 \text{ m}^3 \text{ (trap loss)} = 28,000 \text{ m}^3$$

$$5.3\% \text{ to } 4.4\%$$



PROJECT

490-200

SHEET

4

DETAILS

Winderwerk Basin

DATE

June 22/88

BY

GH

CHECKED BY

Slope/Dyke Schemes - Summary

Summary.

<u>Scheme</u>	<u>Basin Volume Reduction</u>	<u>Estimated Cost</u>
000m 1:3 full slope	5.7 to 6.9% (6.3%)	250,000
000m 1:5 part slope	2.0 to 2.5% (2.2%)	100,000
000m Dyke Scheme	4.4 to 5.3% (4.8%)	350,000



605 James Street North
Hamilton, Ontario
Canada L8L 1K1

Telephone: (416) 525-4330
Telex: 061-8638